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Title: RADIOACTIVE WASTE CHARACTERIZATION OF CPP-603 CLEANUP BASIN SYSTEM - CPP-740

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RADIOACTIVE WASTE

CHARACTERIZATION OF CPP-603

CLEANUP BASIN SYSTEM

SYSTEM CPP-740

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1. INTRODUCTION AND SUMMARY

The Waste Programs division of EG&G Idaho, Inc. and Exxon Nuclear Idaho Company (ENICO) have completed a physical and radiological characterization of the CPP-603 fuel storage basin cleanup support system located at the CPP-740 area of the Idaho Chemical Processing Plant (ICPP). This work was performed in anticipation of possible facility decontamination and decommissioning (D&D). The area is as outlined in "Decontamination and Decommissioning--Long Range Plan--Idaho National Engineering Laboratory" (Report PR-W-79-005), Appendix-B, Section 3.1.

This report describes the currently known CPP-603 Fuel Storage Basin cleanup support system relative to the facilities located at CPP-740. Surface and internal radiation fields, contamination, and radionuclides present are documented. In addition, an estimate of the weight and volume of contaminated waste is given.

2. CPP-740 FUEL STORAGE BASIN CLEANUP SUPPORT SYSTEM BACKGROUND HISTORY

The Fuel Receiving and Storage Facility (FRSF) (CPP-603) is a facility located at the extreme south end of the ICPP (see Figure 1). Prior to fuel reprocessing at ICPP, spent fuel assemblies are stored at the basin area until a sufficient amount of fuel is accumulated for a reprocessing run. The fuel is stored in three deep basins in CPP-603, an "E" shaped building shown in Figure 2. The basins are filled with water with approximately 20 feet of cover over the fuel assemblies to provide radiation shielding. The FRSF was constructed in 1951; since then, accumulations of suspended dirt and dead algae have limited the visibility of the water, which, in turn, has limited the fuel transfer operations within the basins.

When FRSF was constructed, a filtration system was included with the facility; this was the BIF[a] filter system. The BIF filter system is a swimming pool type with diatomaceous earth filter aid as shown in Figure 3. In this system, basin water was recirculated continuously at a rate of 200 to 250 gpm. The water was pumped from the pump pit to the filter unit located in the annex room at the east end of the middle storage wing as shown in Figure 4; the water was then returned to the storage basins.

The BIF filter was backwashed periodically when the pressure drop became too high (usually 18 in. Hg) or when the system experienced a power failure. The backwash slurry of filter aid material and backwash water was then pumped to CPP-301, a concrete settling vault 5 ft by 5 ft by 23 ft deep. (See Figure 5). When the slurry settled, the supernatant was then drained from the settling pit to a deep dry well, CPP-303, where the effluent was essentially released to the surrounding soil. The settling period usually required the slurry to settle overnight, hence holding up backwashing of the BIF filter until the supernatant was drained out. It was for this reason that in 1962 a horizontal settling basin, shown in Figure 6, was constructed adjacent to the CPP-301 pit.

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a. BIF division of General Signal Corporation.

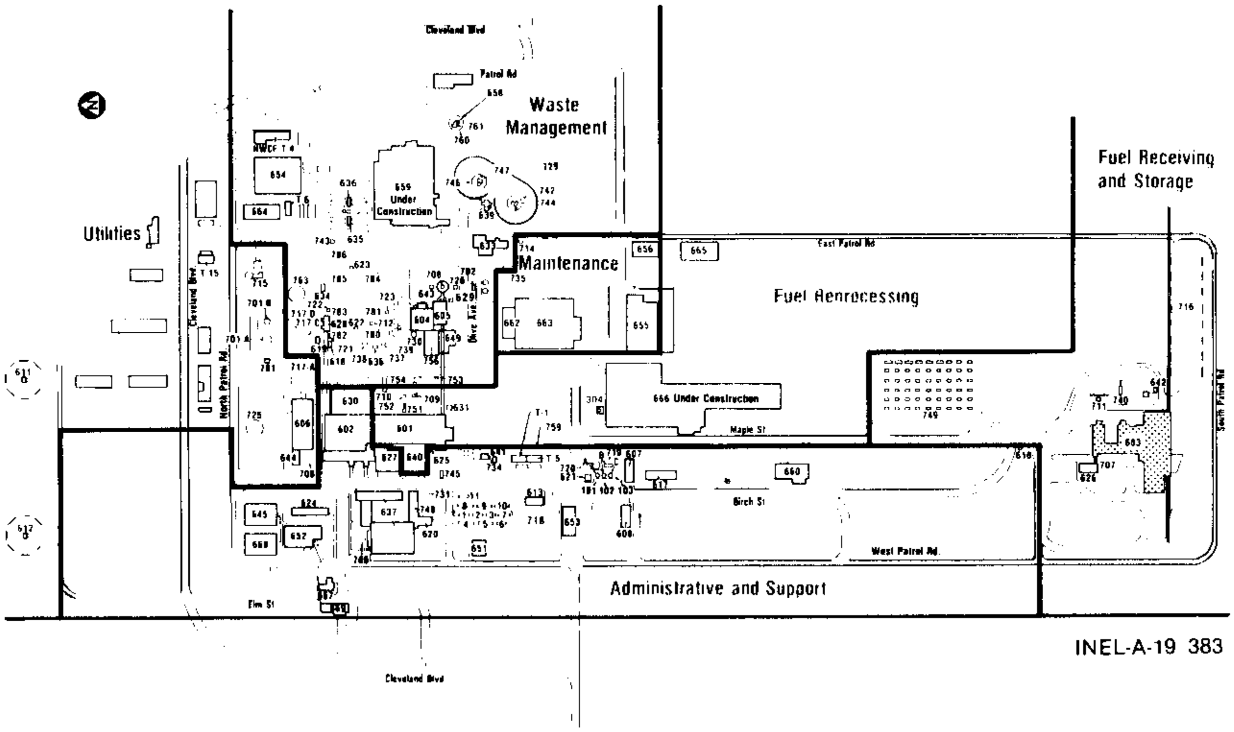

Figure 1. Plot plan of ICPP.

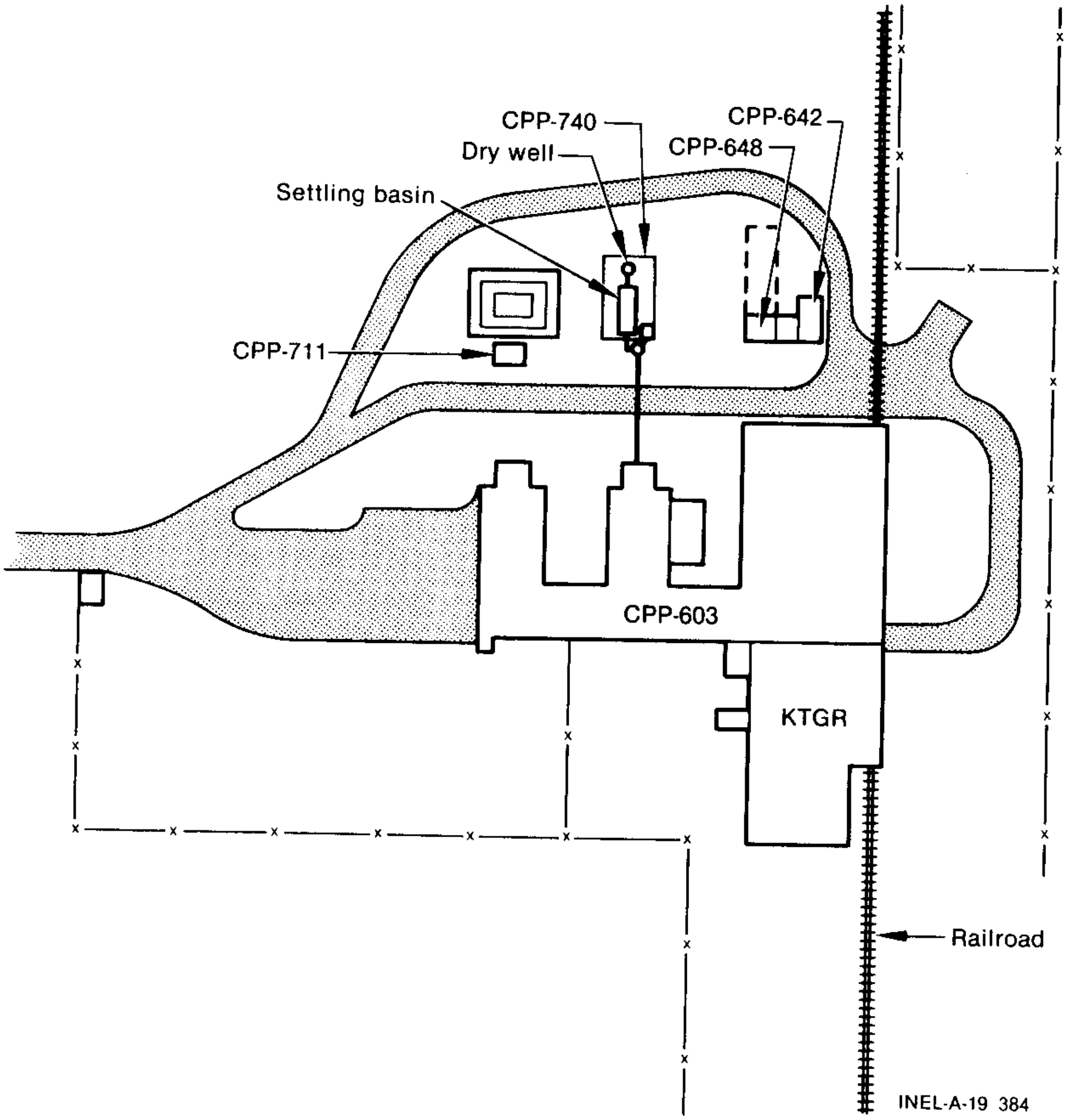

Figure 2. Plot plan of FRSF.

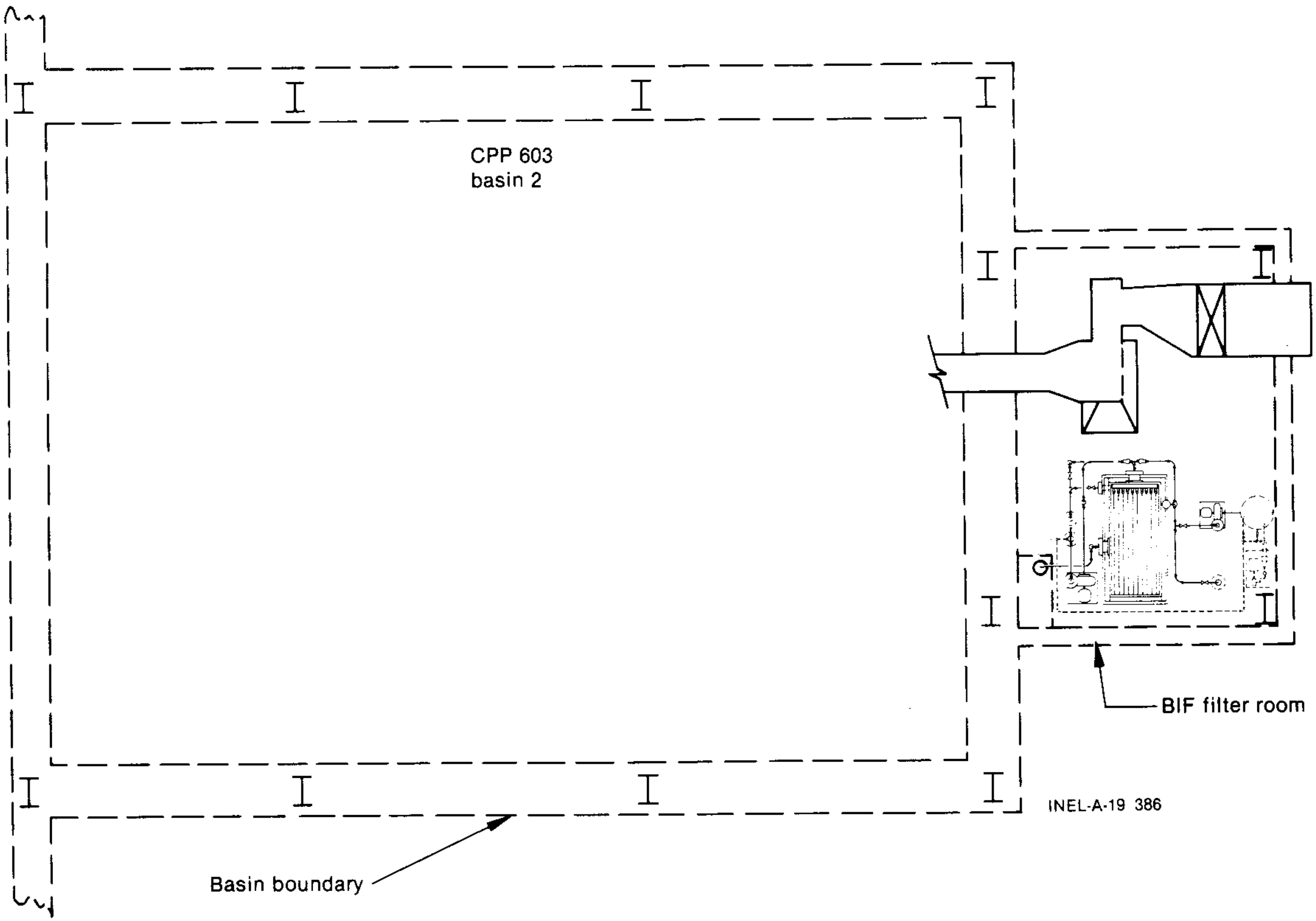

Figure 3. BIF filter room plot plan.

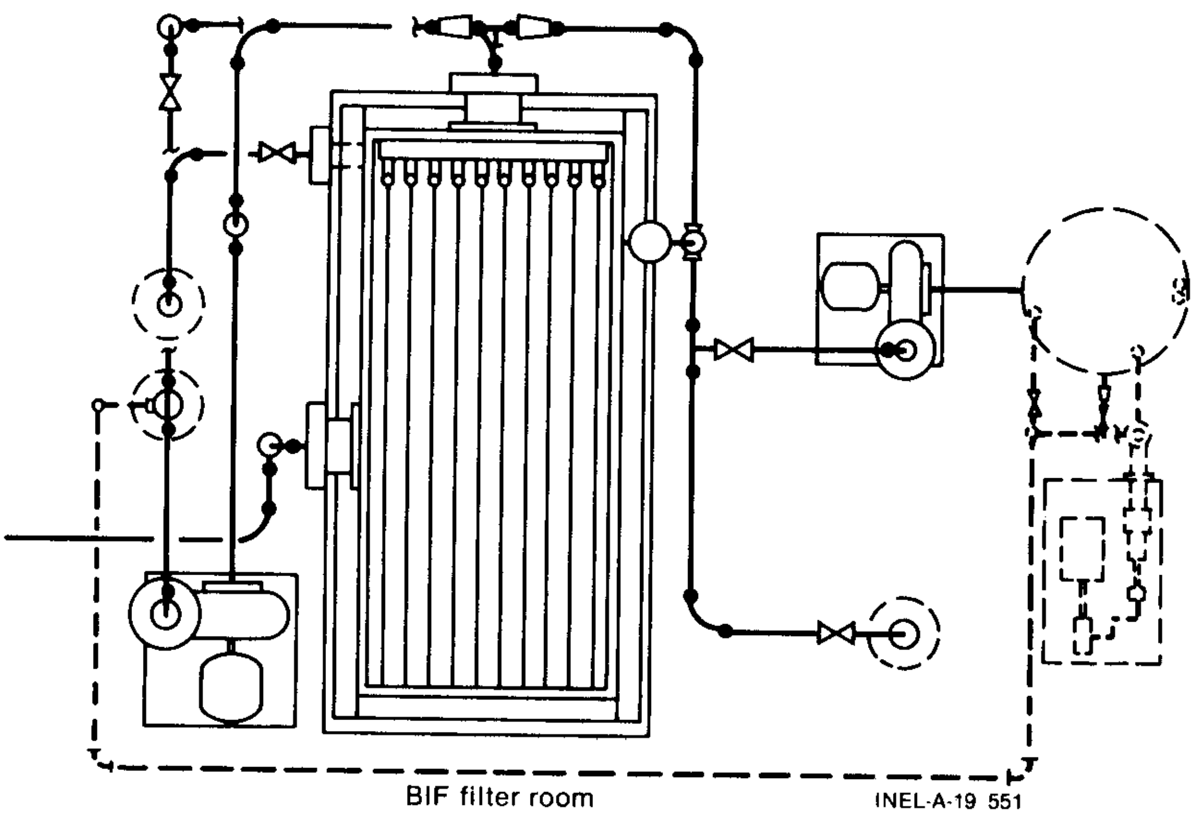

Figure 4. BIF filter, plan view.

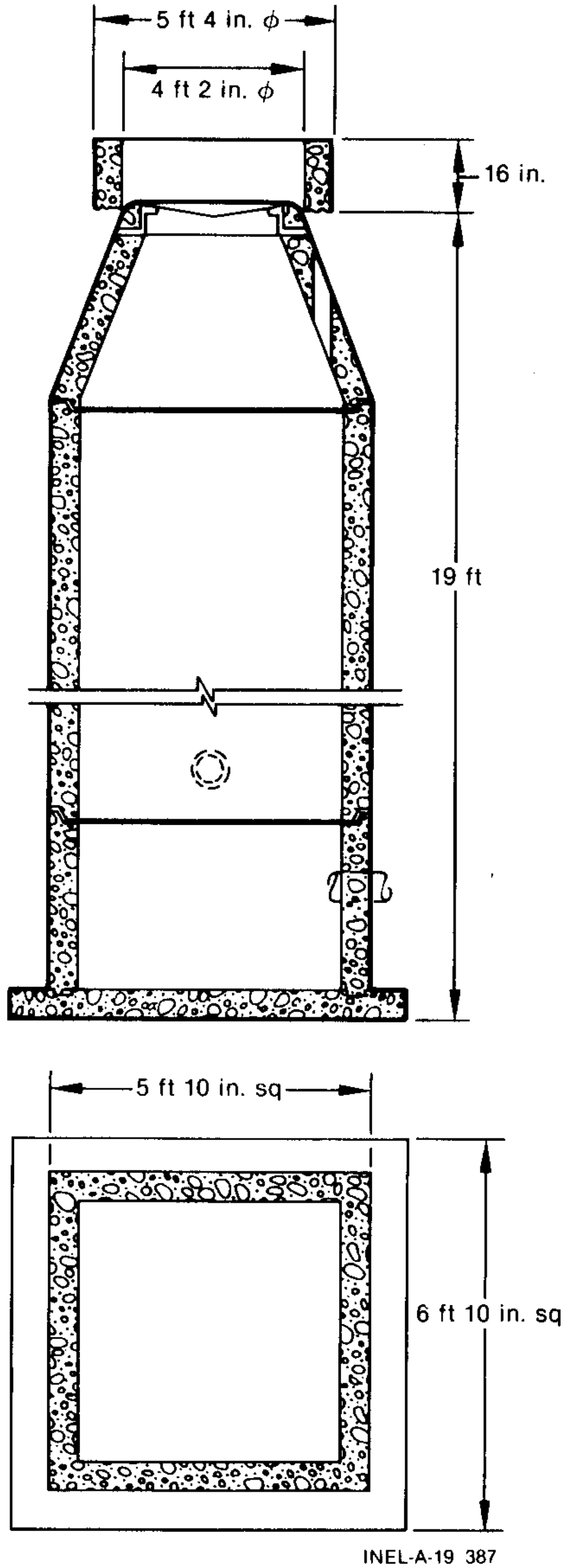

Figure 5. Settling vault CPP-301.

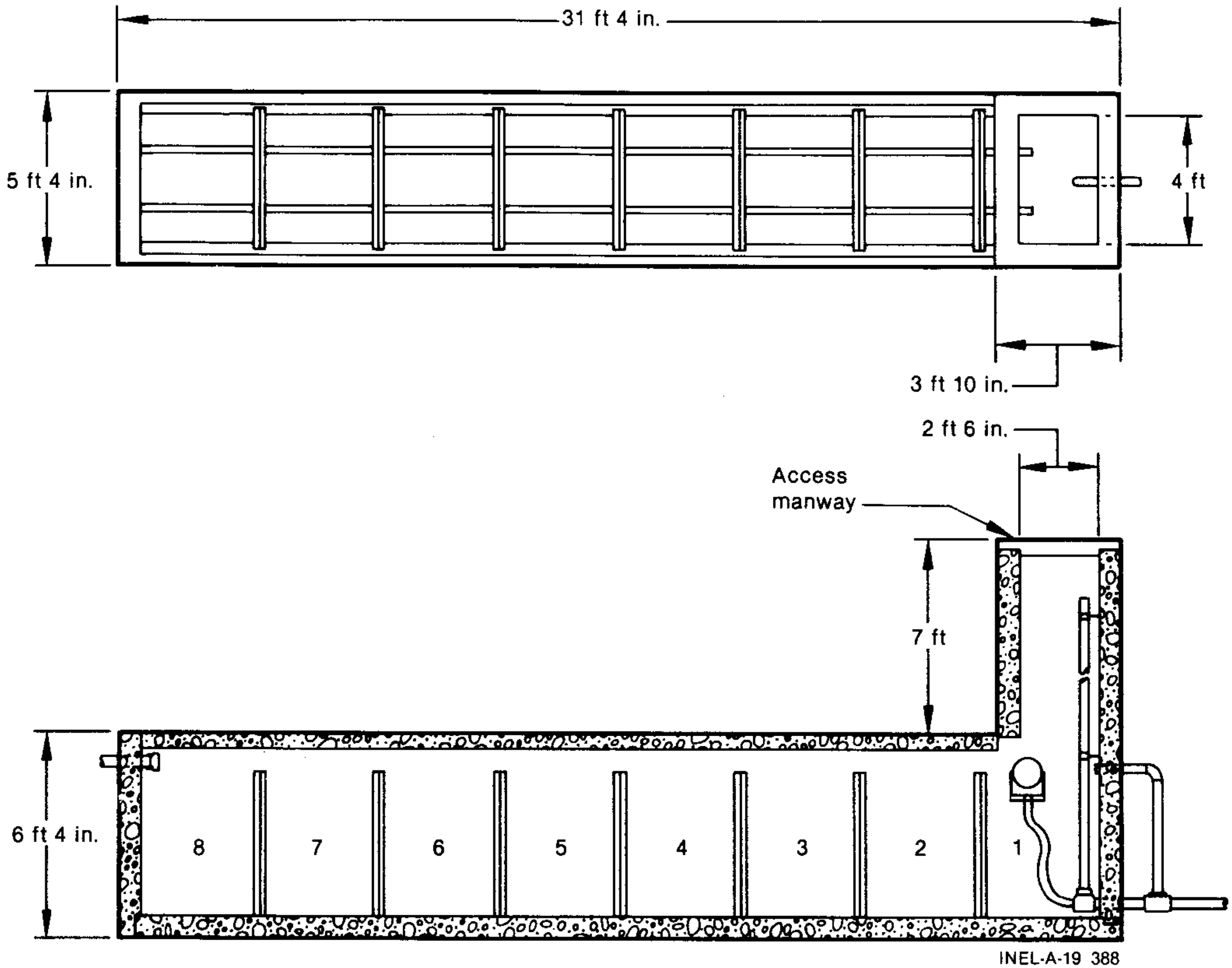

Figure 6. Horizontal settling basin in CPP-740.

In this new system, the slurry was washed over a series of weirs where the filter aid material was separated from the slurry stream, and the fluid was drained into a open drywell, MAH-SFE-SW-048, shown in Figures 7 and 8. With the settling basin in operation, the CPP-301 settling pit was valved out of operation.

Since 1966 no waste water has been released into the ground due to tighter environmental regulations, and so the use of the horizontal settling basin was ceased. A partial record of the activity discharges during this time is shown in Table 1 along with the backwash water discharges. The total activity discharged to the horizontal settling basin is 5.6 curies for the actual months reported. The values are graphed in Figure 9 and show a steady decrease in activity discharges to the settling basin facility between June 1962 and September 1966. Further, it was noted by several basin personnel that the settling basin was accessed on occasion to remove the accumlation of diatomaceous earth filter aid within the weir compartments. Since the settling basin could not be used, the previous method of using the CPP-301 settling pit was reactivated. But instead of draining the supernatant to the CPP-303 dry wells, the effluent was settled out to a hot waste tank where it was transferred at a later time to a waste evaporator.

The ceasing of water discharges into the ICPP ground had limited the operations of the fuel storage basins. This limitation in operations was caused by increases in the growth of algae and the subsequent increase of the amount of sludge within the basin waters. To provide proper water clarity for spent fuel assembly manipulation, the demand on the BIF filter was increased. Thus, a greater number of periodic filter backwashes was required. In March of 1969, the activity in the basin water increased rapidly due to the rupturing of several EBR II fuel canisters. A partial beta activity level profile of the basin water is shown in Figure 10. This graph shows an activity peak in the summer of 1972. Subsequent to 1972, the amount of radionuclides collected in the filter aid material increased, and this eventually caused an increase in radioactivity discharged to CCP-301.

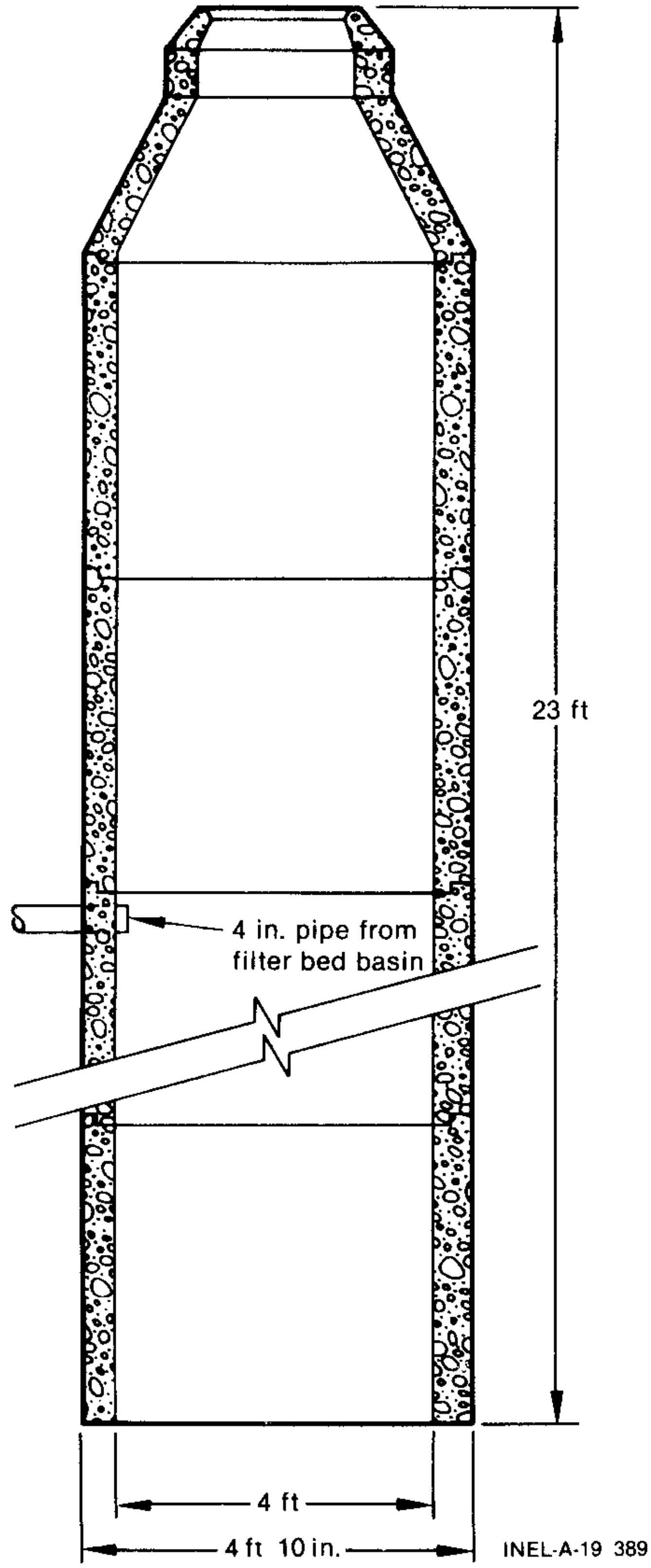

Figure 7. Open dry well, MAH-SFE-SW-048.

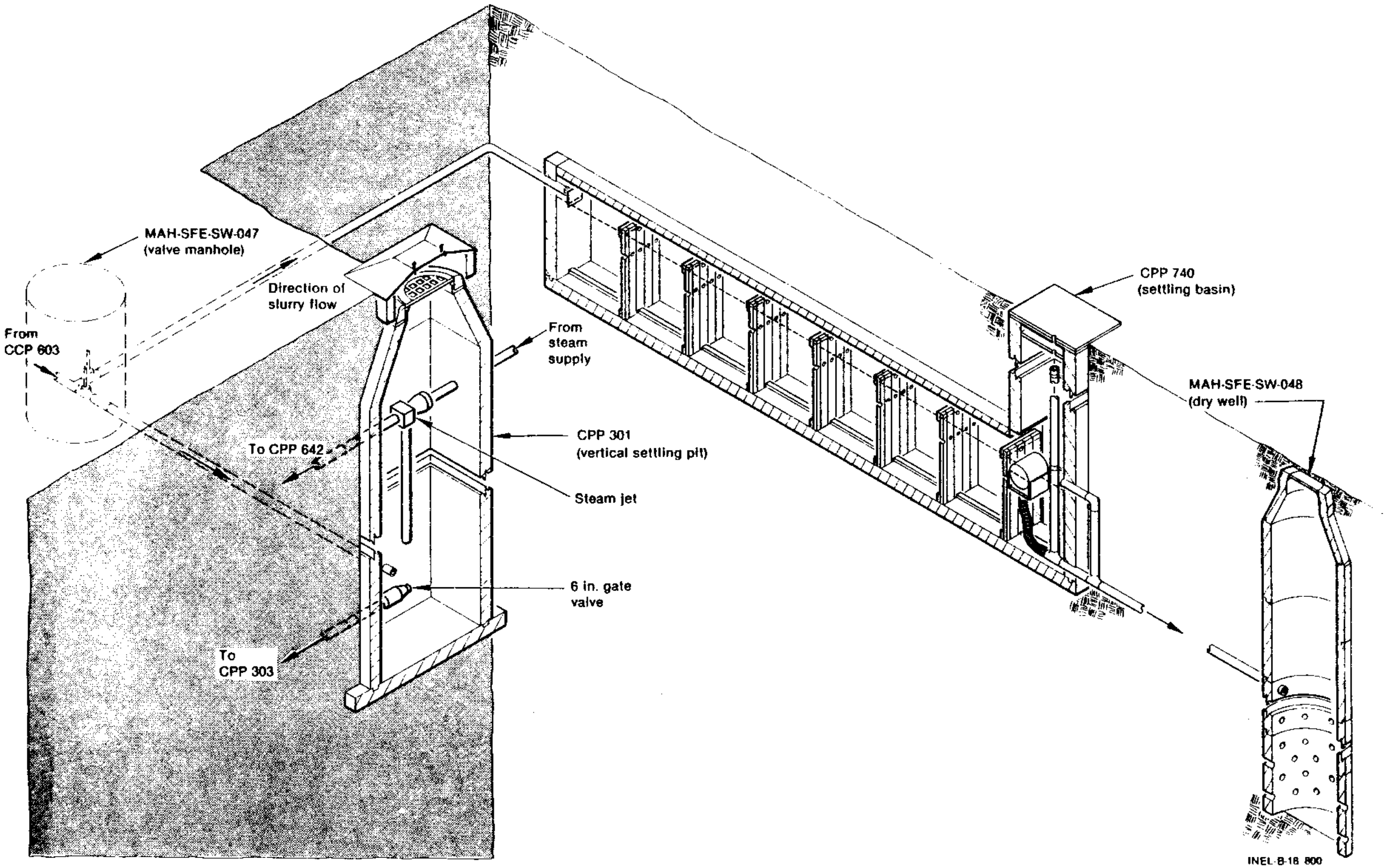

Figure 8. CPP-740 facility isometric.

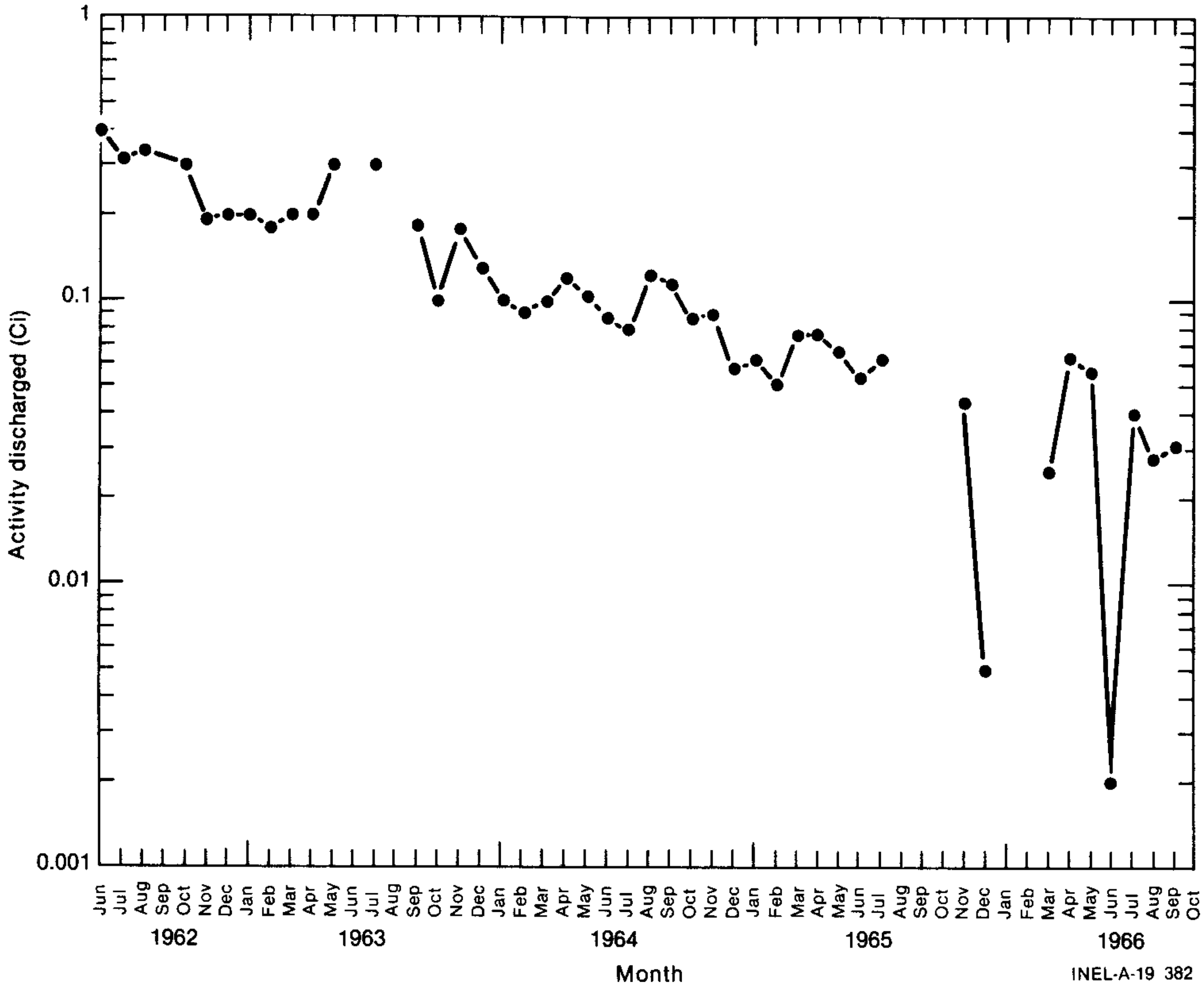

Figure 9. Activity discharges to CPP-740.

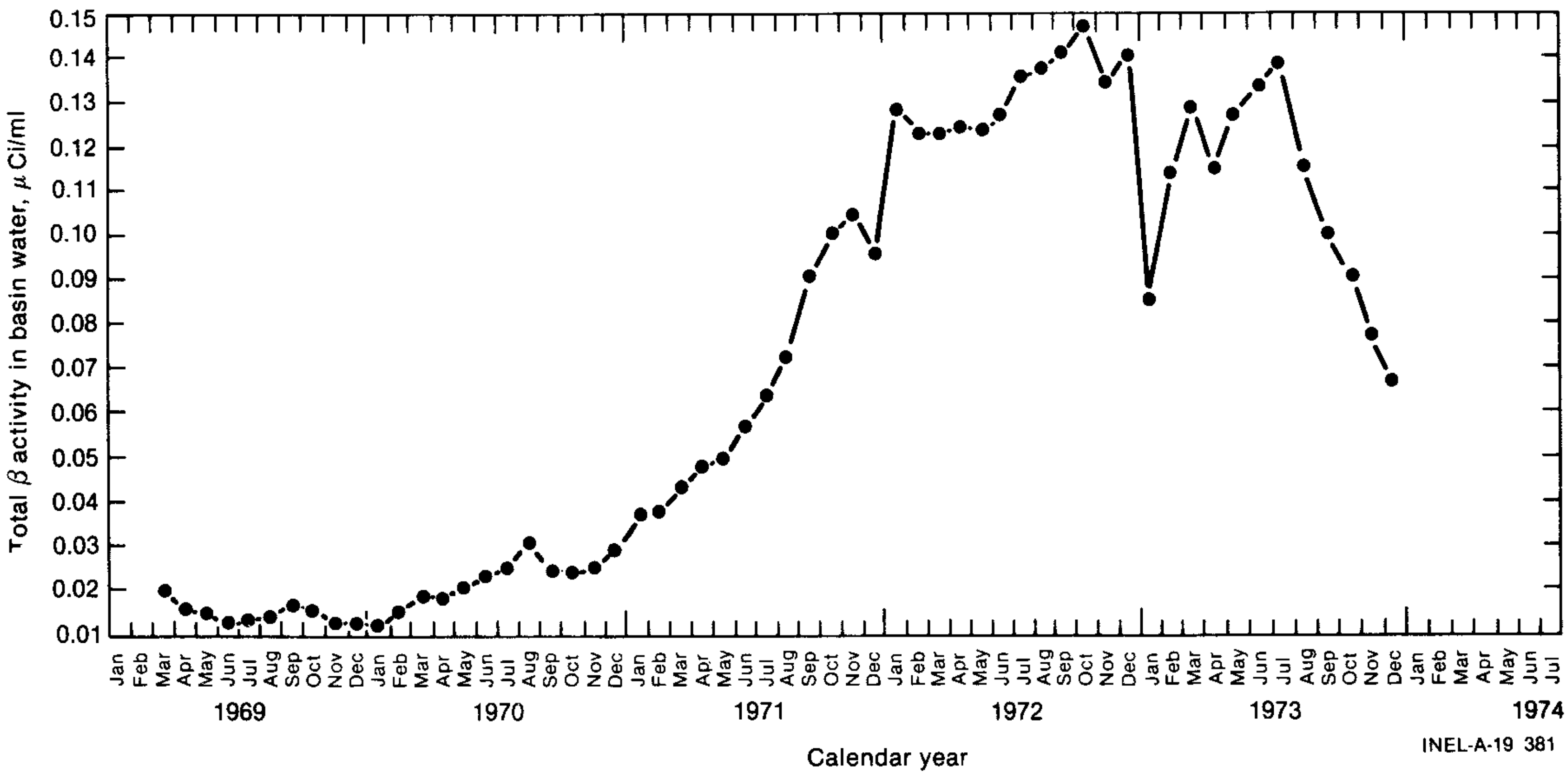

Figure 10. Beta activity in CPP-301 basin waters.

TABLE 1. ACTIVITY AND WATER DISCHARGES FROM BIF FILTER INTO HORIZONTAL SETTLING BASIN

Month	Year	Activity Discharged (Ci)	Water Discharged (Gallons)
June	1962	0.400	27,000
July		0.315	21,000
Aug.		0.340	19,500
Sept.		a	a
Oct.		0.302	22,500
Nov.		0.193	18,000
Dec.		0.200	18,000
Jan.	1963	0.200	18,000
Feb.		0.180	18,000
Mar.		0.200	19,000
Apr.		0.200	18,000
May		0.300	18,000
June		a	a
July		0.300	15,000
Aug.		a	a
Sept.		0.185	10,500
Oct.		0.100	9,000
Nov.		0.180	15,000
Dec.		0.130	12,000
Jan.	1964	0.100	12,000
Feb.		0.091	12,000
Mar.		0.100	12,000

TABLE 1. (continued)

Month	Year	Activity Discharged (Ci)	Water Discharged (Gallons)
Apr.		0.120	15,000
May		0.104	13,500
June		0.088	12,000
July		0.079	13,000
Aug.		0.126	18,000
Sept.		0.116	18,000
Oct.		0.086	13,000
Nov.		0.090	13,500
Dec.		0.058	9,000
Jan.	1965	0.062	9,000
Feb.		0.050	10,000
Mar.		0.076	13,500
Apr.		0.077	12,000
May		0.067	12,000
June		0.054	12,000
July		0.062	12,000
Aug.		a	a
Sept.		a	a
Oct.		a	a
Nov.		0.044	9,000
Dec.		0.005	10,500
Jan.	1966	a	a
Feb.		a	a

TABLE 1. (continued)

Month	Year	Activity Discharged (Ci)	Water Discharged (Gallons)
Mar.		0.025	12,000
Apr.		0.064	13,500
May		0.057	12,000
June		0.002	6,000
July		0.040	7,500
Aug.		0.028	6,000
Sept.		0.031	6,000

a. Production report not available for that month.

The use of the CPP-740 settling facilities was terminated in early 1977 when a system of pressurized solid filters replaced the BIF filter system. A cleanup of the contaminated filter aid deposits in the CPP-301 pit was initiated by Allied Chemical Corporation (the ICPP operating contractor during this period) and Chem-Nuclear Systems Inc. of Tacoma, Washington. The resultant cleanup of the filter aid deposits of the CPP-301 pit removed the material but also spread contamination into the CPP-740 area; this contamination required a backfill of dirt to prevent the spread of contaminated soil outside of the CPP-740 area. The installation of the pressurized sand filter system had rendered the CPP-740 facilities obsolete; thus, the feed lines from the CPP-603 facility were flanged off, isolating CPP-740. During periodic inspections of the CPP-740 area, the diatomaceous earth material contained within the settling basin was found to be hardened and dried out.

3. CPP-740 FUEL STORAGE BASIN CLEANUP SUPPORT SYSTEM DESCRIPTION

The CPP-740 area basically consists of four components and their associated piping. These are two filter aid slurry settling facilities, a dry well, and a valve box manhole. The enclosed area shown in Figure 8 is bounded by six large cylindrical posts, for which a single link chain barrier is erected waist high. The enclosure formed by the chain boundary measures roughly 20 feet by 46 feet. The enclosure has been surveyed by health physics and is classified as a Zone III radiation area, and so the area is not accessible to personnel without required anti-c protection.

The primary purpose of the support system is to receive the backwash slurry of filter aid material from the BIF filter system when filter aid material accumulations initiate a pressure drop across the BIF filter elements greater than 18 in. Hg. To accomplish this task, the CPP-740 has two settling facilities for the slurry settling. The first is a settling vault, CPP-301, which measures 5 feet by 5 feet square by 19 feet deep and is shown in Figure 5. This structure is constructed of 5-inch thick, square concrete barrels, each approximately 4 feet high, and a platform-type of floor structure. The facility has personnel access capability from metal rings which lead to the bottom of the vault. Further the vault contains a liquid jet which is used to jet out the supernatant from the vault into a liquid hot waste tank (SFE-20).

The other filter aid material settling facility is a horizontal settling basin shown on Figure 6. This facility is a horizontal vault measuring internally 4 feet wide by 5 1/3 feet high by 30 feet long. Most of the facility is buried under seven feet of backfill dirt; hence, access to the facility is accomplished only through a rectangular manway which leads to the final (#1) weir compartment. The facility consists of this manway and eight weir compartments. These compartments are formed by redwood weirs which measure 4 1/2 feet by 4 feet and are constructed of 2 by 6 redwood planks. Structurally, the facility is constructed from wire reinforced concrete slabs, ranging from 4 inches to 8 inches in thickness.

Further, there are four triangular counter fort walls which support the side walls of this facility.

The horizontal settling basin has an associated dry well as shown on Figure 7. This dry well was constructed in conjunction with the horizontal basin. The dry well is essentially a bottomless type with the intent that all liquid effluents discharged into it would be absorbed into the surrounding ground. Dimensionally, the dry well is 4 feet in diameter and 23 feet deep. Structurally, the dry well is constructed from 4 feet high, 5 inch thick concrete barrels, with a 2 foot manhole for maintenance and access purposes.

The process of the CPP-740 basin cleanup support system is to receive the backwash slurry of filter aid material from the BIF filter. When the pressure drop accross the BIF filter elements becomes too great, the elements are required to be washed of filter aid material and a new coat of the material is installed. The old filter aid material was washed off the BIF elements by FRSF personnel using a 5/8 inch hose or by a automatic spray system. The slurry was then drained off into a 4-inch pipe, out of the CPP-603 facility building, across a driveway, and into the CPP-740 area as shown by Figure 11.

The slurry of backwashed filter aid material flows into a valve box manhole, MAH-SFE-SW-047, where the flow is diverted into the CPP-301 vault. By procedure, the slurry is allowed to settle for three days; then the supernatant is jetted out by a liquid jet installed inside the vault to a liquid hot waste hold tank, SFE-20, located in CPP-642. After a period of time in SFE-20, the liquid waste is then transferred to the process equipment waste (PEW) evaporator, where the liquid effluent is evaporated.

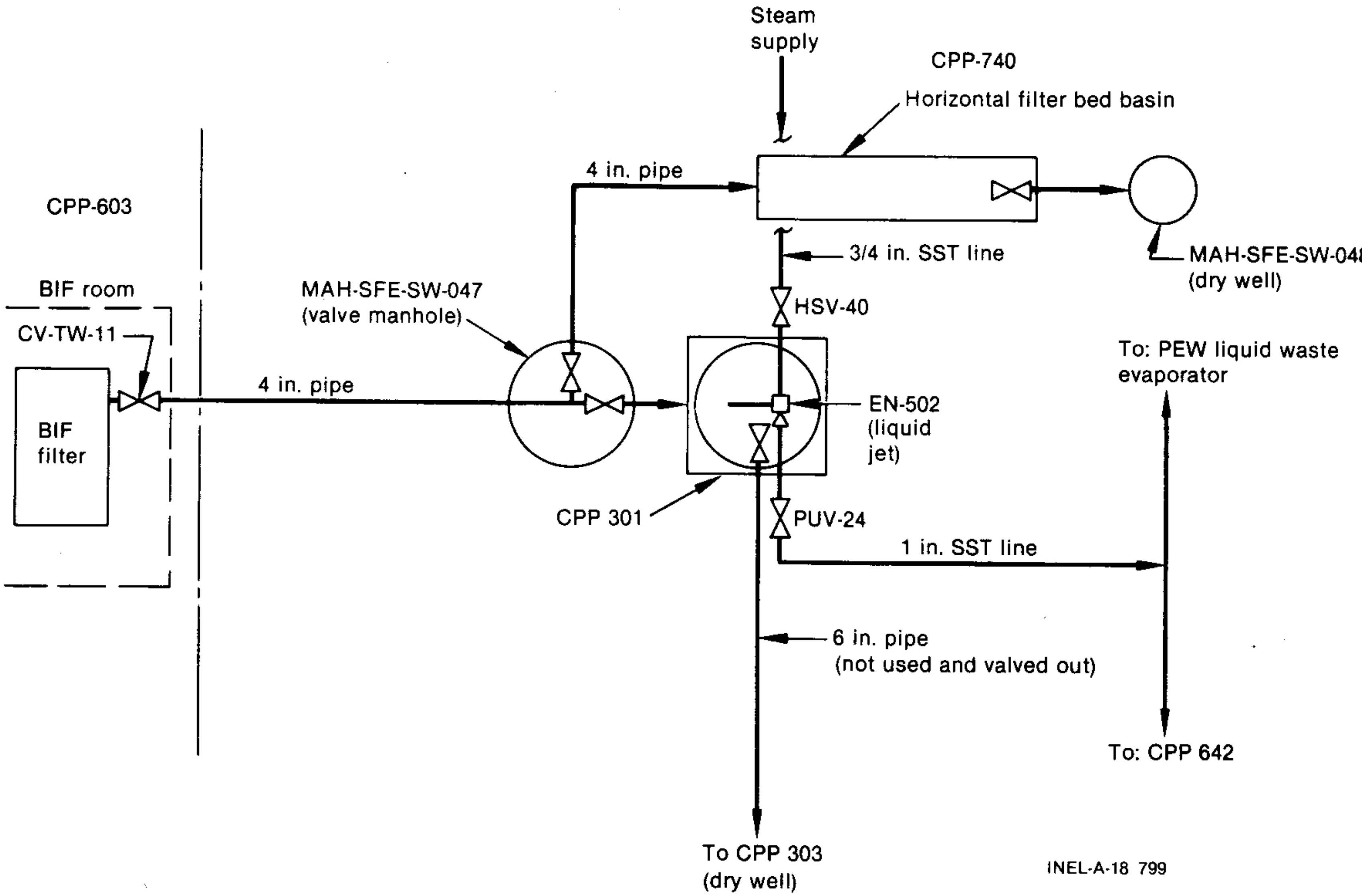

Figure 11. CPP-740 basin cleanup support system process diagram.

4. CHARACTERIZATION METHODOLOGY AND RESULTS

4.1 Methodology

A three-phase approach was used to characterize this facility. The three approaches are:

1. Radiation survey of the two filter aid settling facilties and dry well.

2. Sampling of the material contained in the above-mentioned facilities for radioisotopic analysis.

3. Soil sampling of the CPP-740 area soil for radionuclide analysis.

Radiation surveying of the two filter aid settling facilities and dry well were accomplished by the use of conduit and TLD (Thermoluminescence Dosimetry) lithium fluoride chips. The TLD chips are encased in personnel film badges and then plastic-bagged to prevent damage if the unit is accidently immersed in water. The TLD chips are then spaced on specific intervals on the conduit, which is above the water level, and then inserted in the center of the facility access for 5 minutes. A profile of the radiation fields would then develop showing the strength of the fields as a function of depth. To complete the radiation survey, smear samples of the before-mentioned facilities were performed to estimate the amount of free surface contamination.

Because of the physical limitations imposed by the horizontal filter bed basin, limited radiation surveys could be performed. Complete material sampling of the horizontal settling basin was not possible because most of the basin was inaccessable. Material samples could only be taken from three locations along the basin. These locations were the manway entrance to the horizontal settling basin, the center weir (#5) compartment, and the slurry piping exit (#8) compartment (refer to Figures 6 and 12 for details).

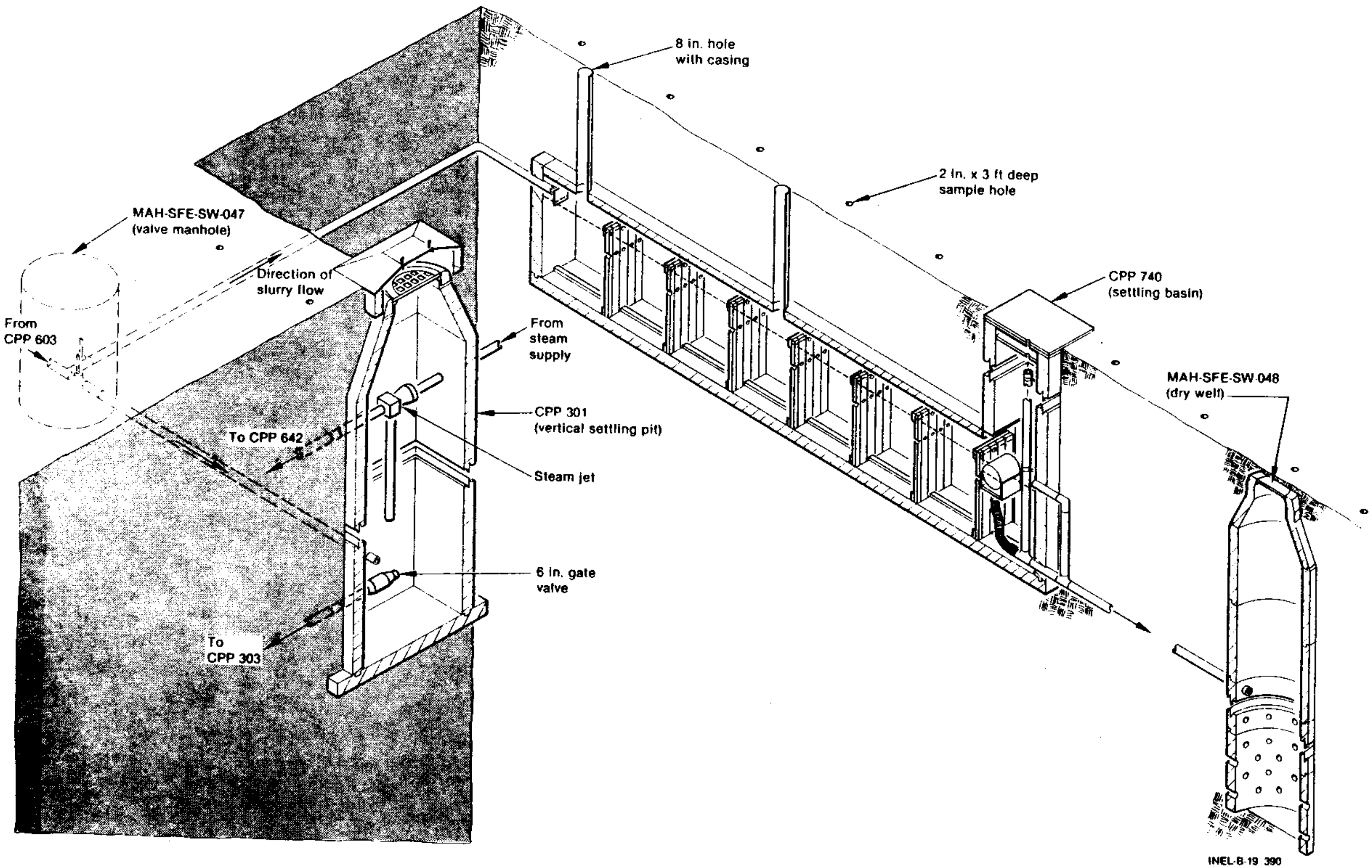

Figure 12. Radionuclide sampling methodology.

Access to the center and exit weir compartments was accomplished by core drilling and casing to the top of the horizontal settling basin. The 4-inch thick concrete rebar reinforced roof was then penetrated to allow a sampling device to be inserted into the compartment and retrieve a material sample.

The leakage of contaminated effluents during the sludge removal operations of early 1978 had presumably left the soil in the CPP-740 area contaminated to such an extent that two feet of clean soil was used to cover the area. To characterize this soil, the CPP-740 enclosure was sectioned into a 5 foot by 5 foot grid as shown in Figure 13. At each intersection, a 3-foot deep core sample was taken by an impact drop hammer technique as shown in Figure 17. Fifty-two samples were extracted and sent to the Test Reactors Area (TRA) Radiation Measurements Laboratory for gamma scanning analysis and fissile material assaying. Included in the 52 samples taken were two 7-foot deep cores which were sunk to the top of the filter bed basin, as shown on Figure 12.

4.2 Visual Observations

The CPP-740 area is basically an underground facility area which can be readily seen by Figures 14 and 15. When the facilities were constructed within the area, backfill dirt and rock of an extremely course nature were used to cover the facilities. This is evident by the representative sample cores that were taken from this area, shown in Figure 16. A layer of gravel was used to cover the top layer of the ground surface, but below the immediate surface, rocks ranging from small pebbles to as large as 3 inches in diameter predominate the fill composition.

It was expected that the diatomaceous earth within the horizontal settling facility would be dry and solid, but evidently ground water from spring rains loaded the settling basin with water. Hence, the diatomaceous earth was well mixed into a thin sludge. With the solids reduced to a

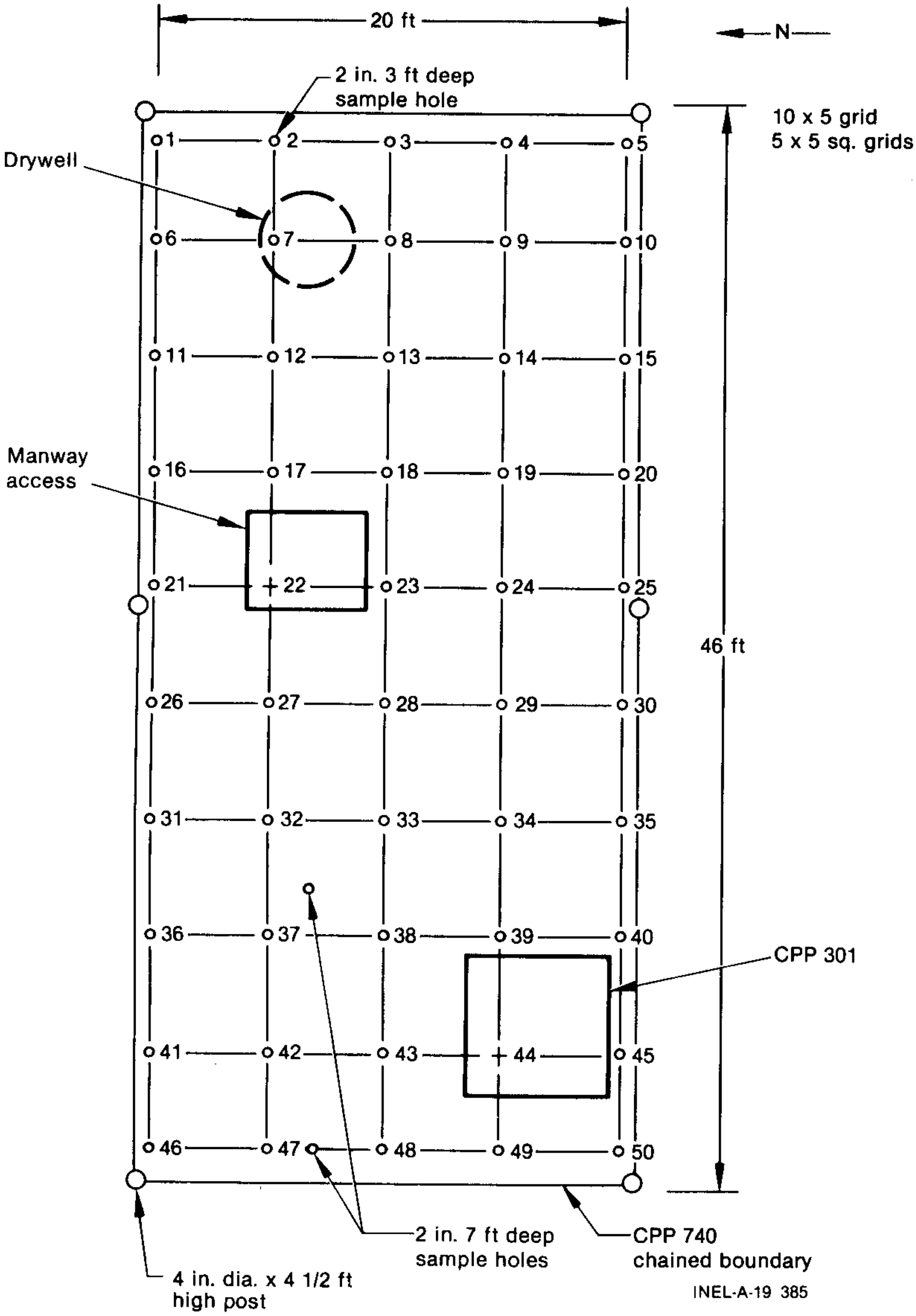

Figure 13. CPP-740 soil sampling grid.

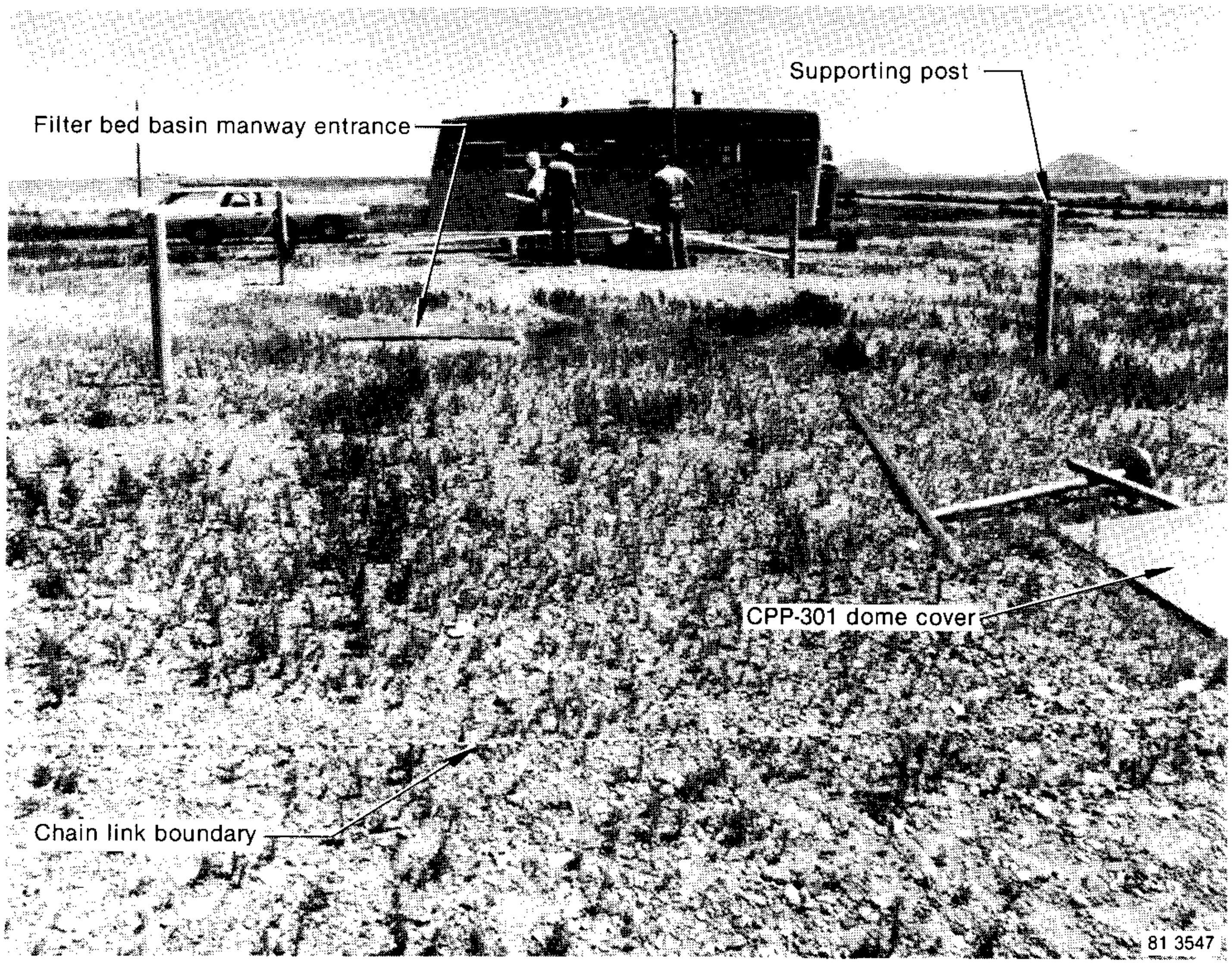

Figure 14. CPP-740 area (facing post).

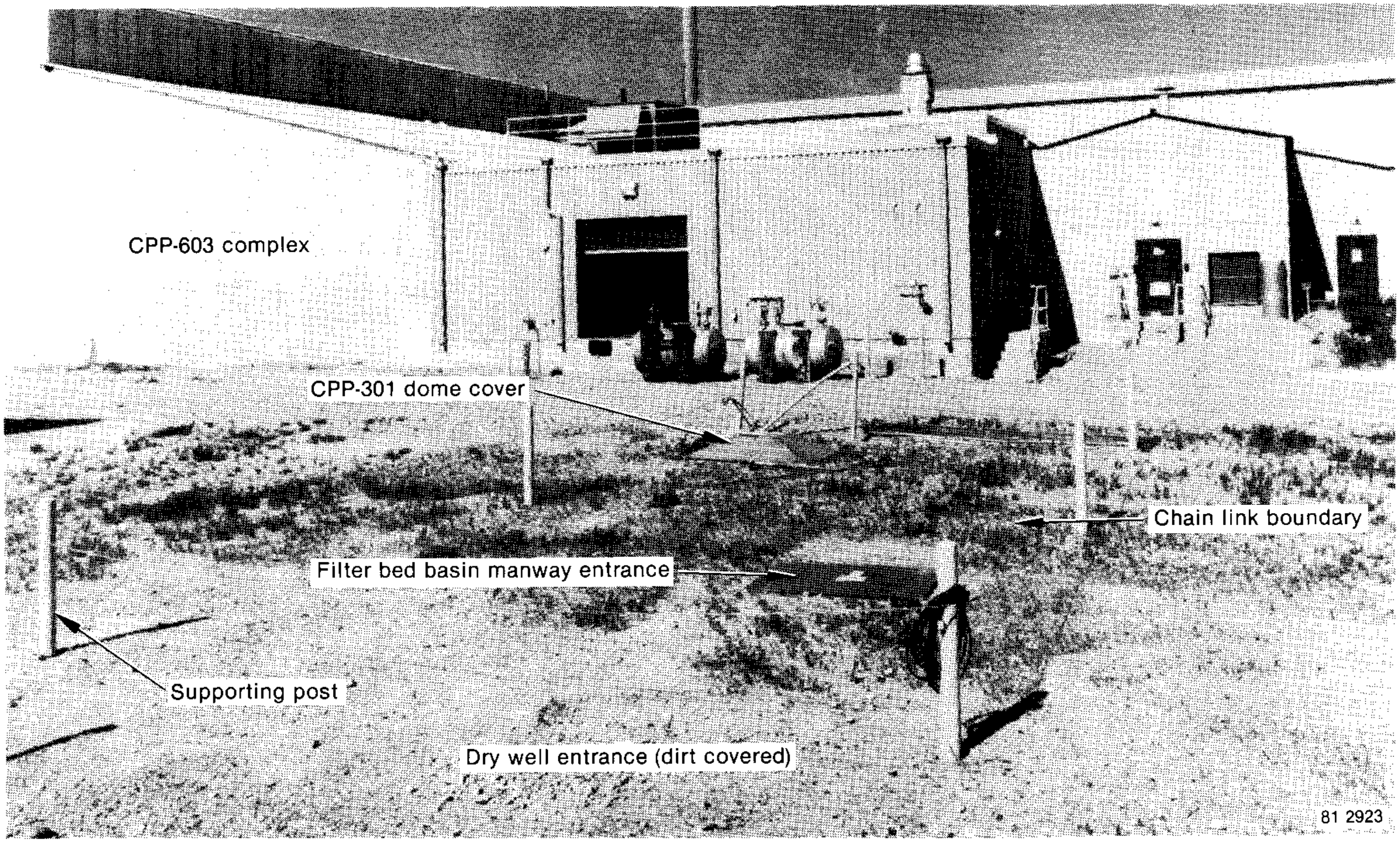

Figure 15. CPP-740 area (facing CPP-603).

Figure 16. CPP-740 soil sample core.

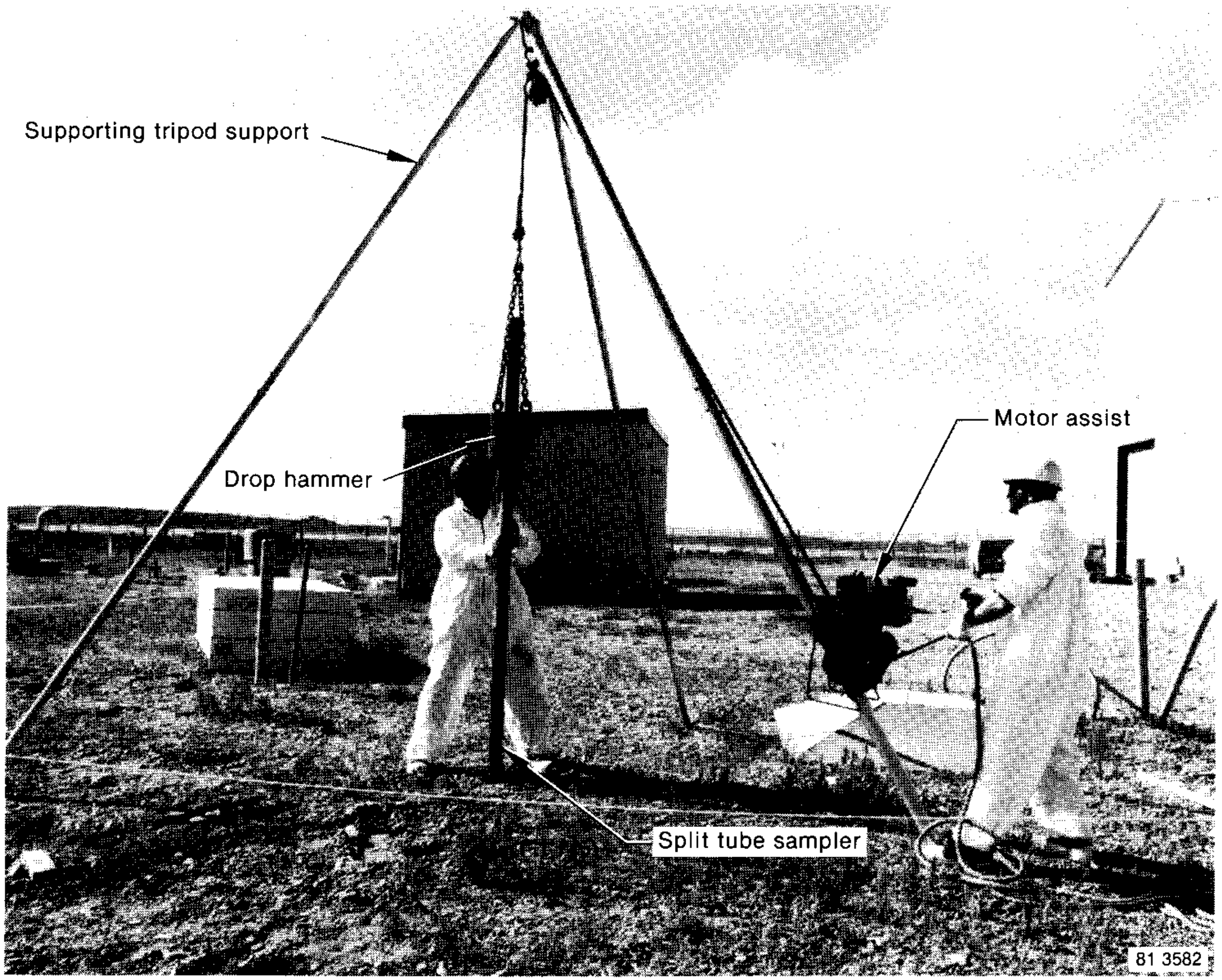

Figure 17. Soil sampling technique.

sludge form, the material within the weirs is fairly homogenous. Hence, the samples taken from this material are expected to be characteristic of the gross material.

During sludge sampling operations on the horizontal filter bed basin, it was determined that the weir compartment #1, which lies under the manway access (refer to Figure 6 for details), was essentially filled with sludge to the top of the weir. The sludge was covered by a 6-inch layer of water which could not be pumped out by FRSF personnel when the water was transferred out of the filter bed basin. However, when the center weir and exit slurry piping weirs were accessed, only minimal amounts of diatomaceous earth were found, although again a 6-inch layer of water was also noted. Further, the access manway into the horizontal filter bed basin was blocked with electrical wiring and surplus piping as shown on Figure 18. These items are not integral with this facility. It is postulated that this material was left by previous maintenance operations in the basin cleanup support system area.

The settling vault CPP-301 was inspected for material content, and it was determined that the vault had a considerable amount of sludge and water within. Since the water level within the vault rose to within 8 feet of the manhole level, a conduit was inserted to determine the water depth within the vault. The determination was that there is still 6 feet of sludge or diatomeacous earth deposits at the bottom of the vault and 5 feet of water still retained by the vault. Further, the manway access to the vault with the protective dome removed is cluttered with old garbage and remains of cinder blocks (this can be seen in Figure 19). The dry well was also inspected and found to be dry and free of solids and filter aid material, as shown by Figure 20. Figure 21 shows the inside of the dry well looking toward the bottom of the well.

Figure 18. Horizontal filter bed basin manway access.

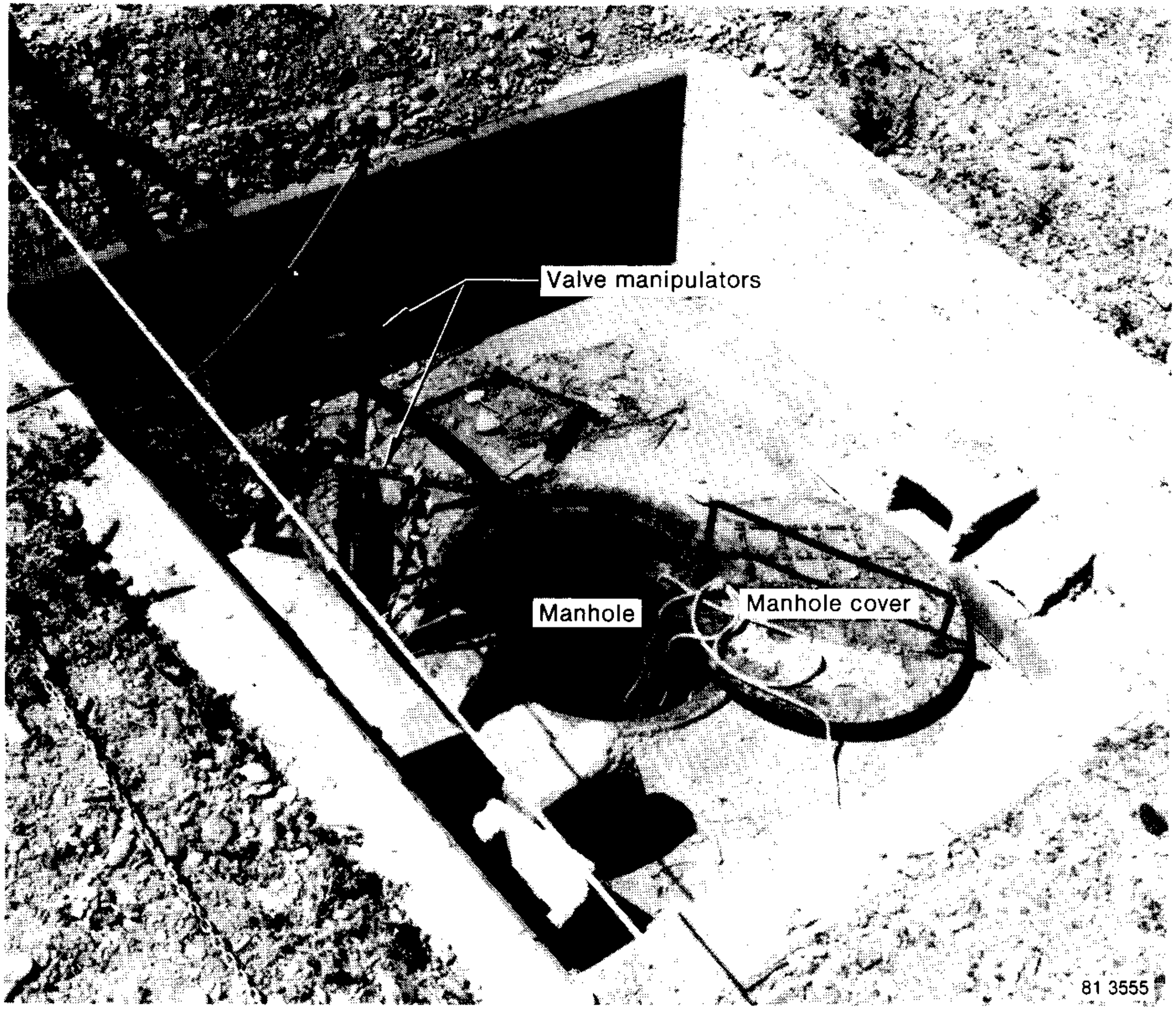

Figure 19. CPP-301 Entrance.

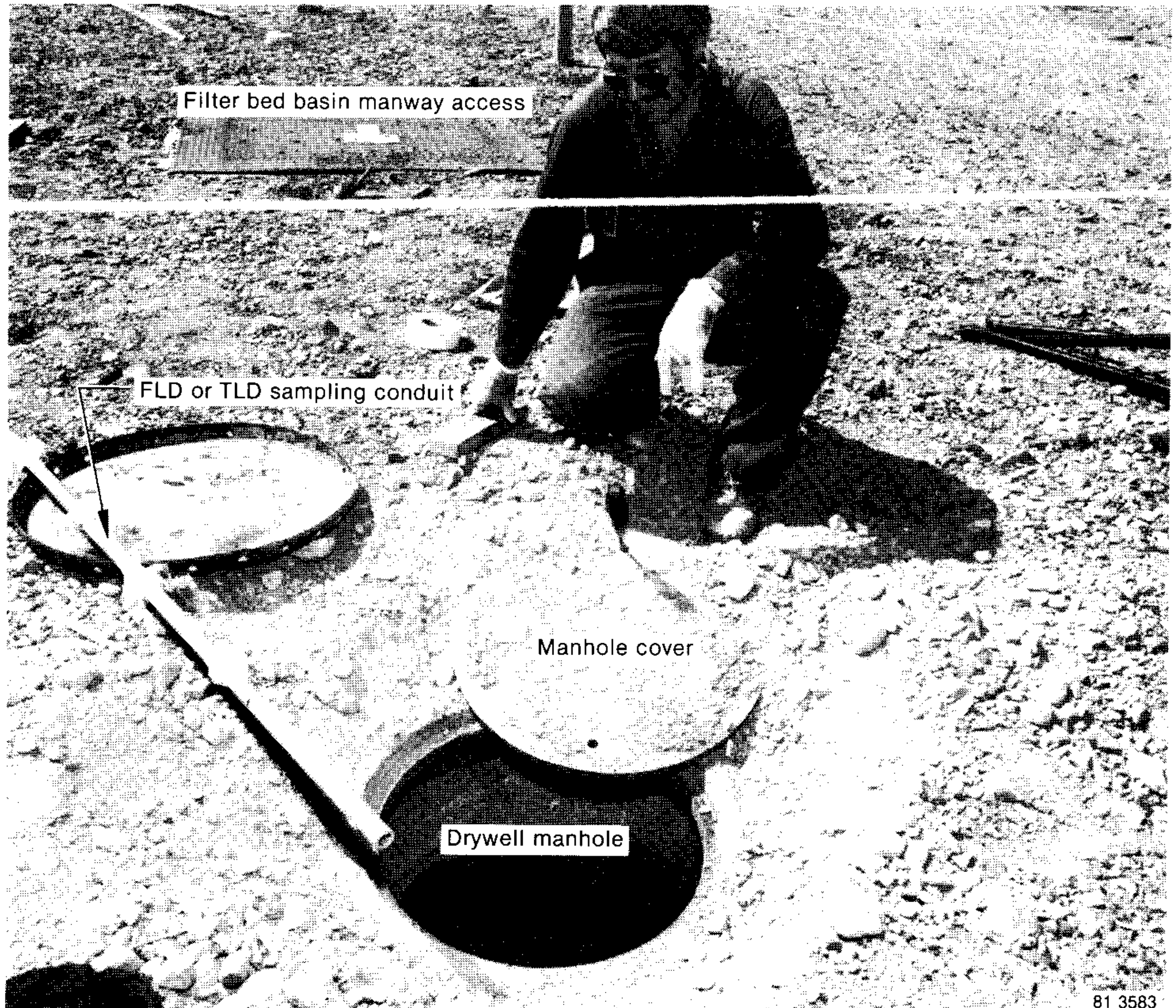

Figure 20. Dry well manhole.

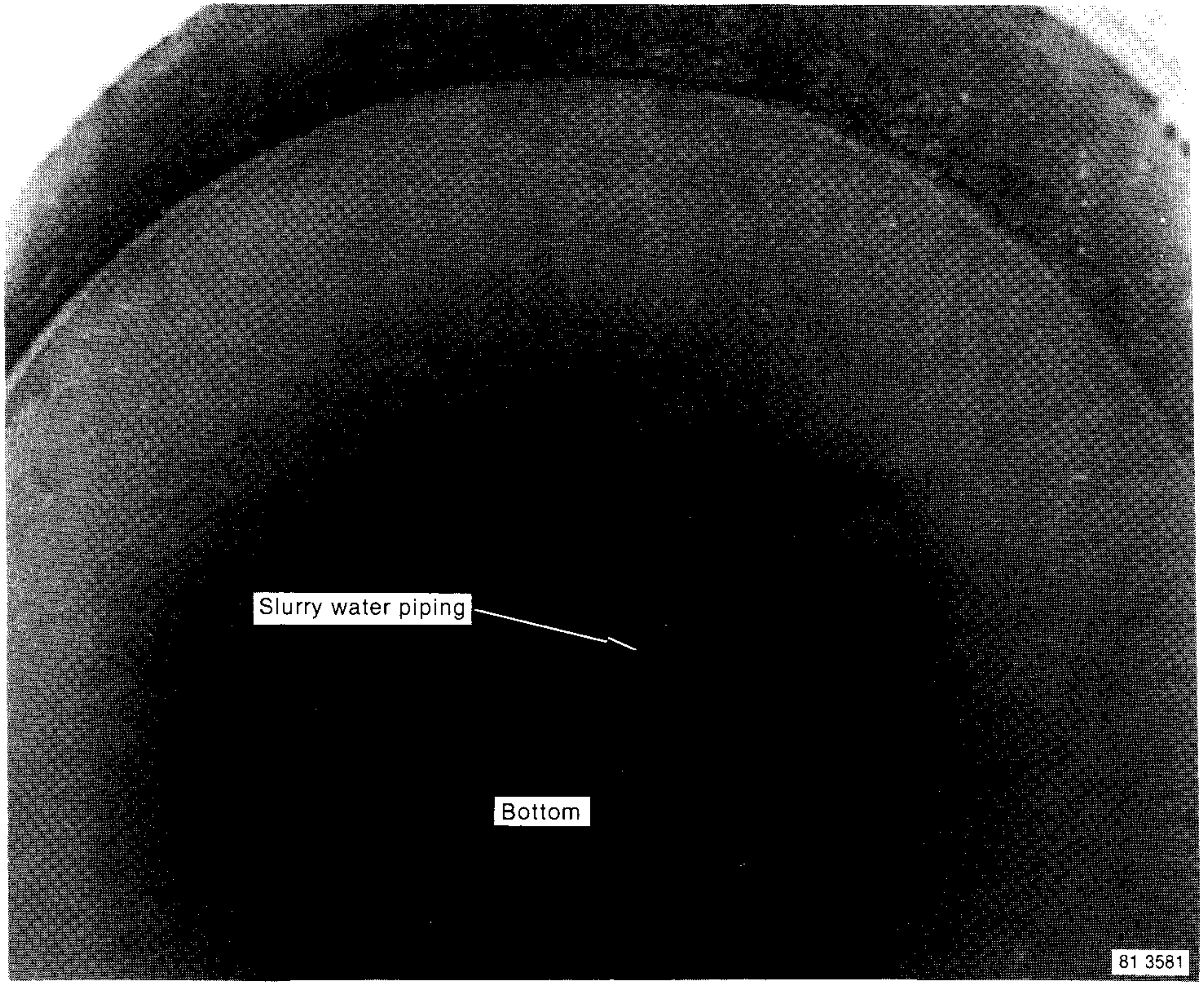

Figure 21. Inside dry well.

4.3 Characterization Results

4.3.1 Radiation Survey

The results of the radiation survey of the settling facilities and dry well are summarized in Figures 22 to 24. High radiation fields predominate close to the vacinity of the sludge deposits; in all cases, the water level seems to affect the gamma radiation reading through attenuation. The waterproof TLD chips that were inserted against the sludge would then give the most accurate reading of the level of the radiation fields present in the sludge. Generally, the sludge readings varied between 655 mR/hr for the manway access weir compartment of the horizontal filter bed basin to 1.008 R/hr for the CPP-301 settling vault. Any readings above this range can be attributed to faulty TLD readings due to impurities which contaminate the chips.

Standard 100 cm^2 smears were taken at the personnel access manways to the two settling facilities and the dry well. These smears were counted in order to get a free contamination measurement in counts per minute (cpm). Radiation dose measurements were also taken in the vacinity of the smears, to correlate the cpm readings to a radiation dose rate.

TABLE 2. RADIATION SMEARS

Location[a]	Radiation Fields mR/hr.[b]	Smears (cpm)
Drywell	0.5 ($\beta+\gamma$)[c]	1500 ($\beta+\gamma$)
Settling basin	1.0 ($\beta+\gamma$)	2890 ($\beta+\gamma$)
Settling pit	3.0 ($\beta+\gamma$)	11,000 ($\beta+\gamma$)

a. Locations are taken at the access manway to the facility.

b. Fields are measured at the immediate vicinity of the smear samples.

c. Measurements are gamma and beta radiation fields combined.

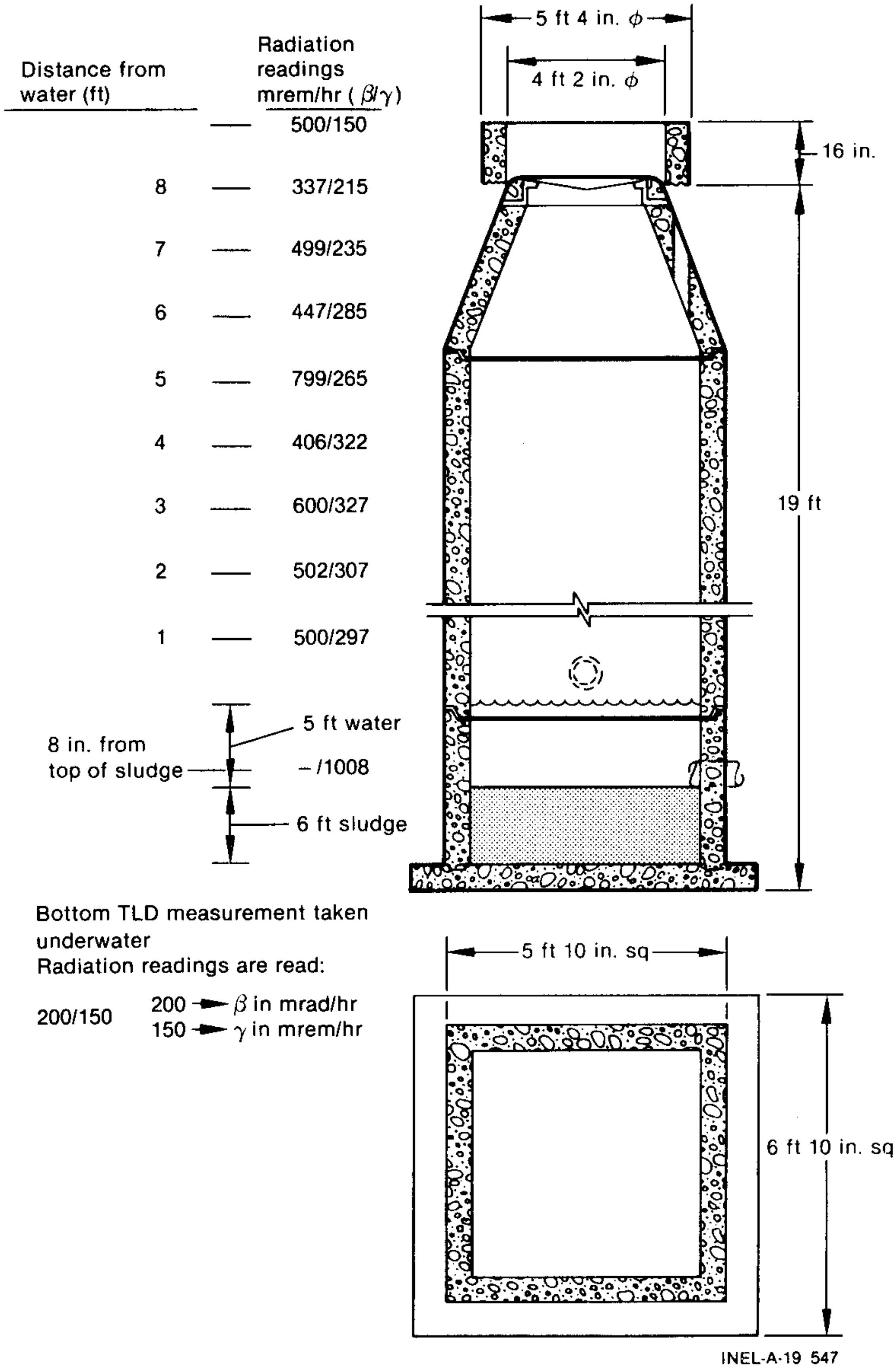

Figure 22. Radiation survey of CPP-301.

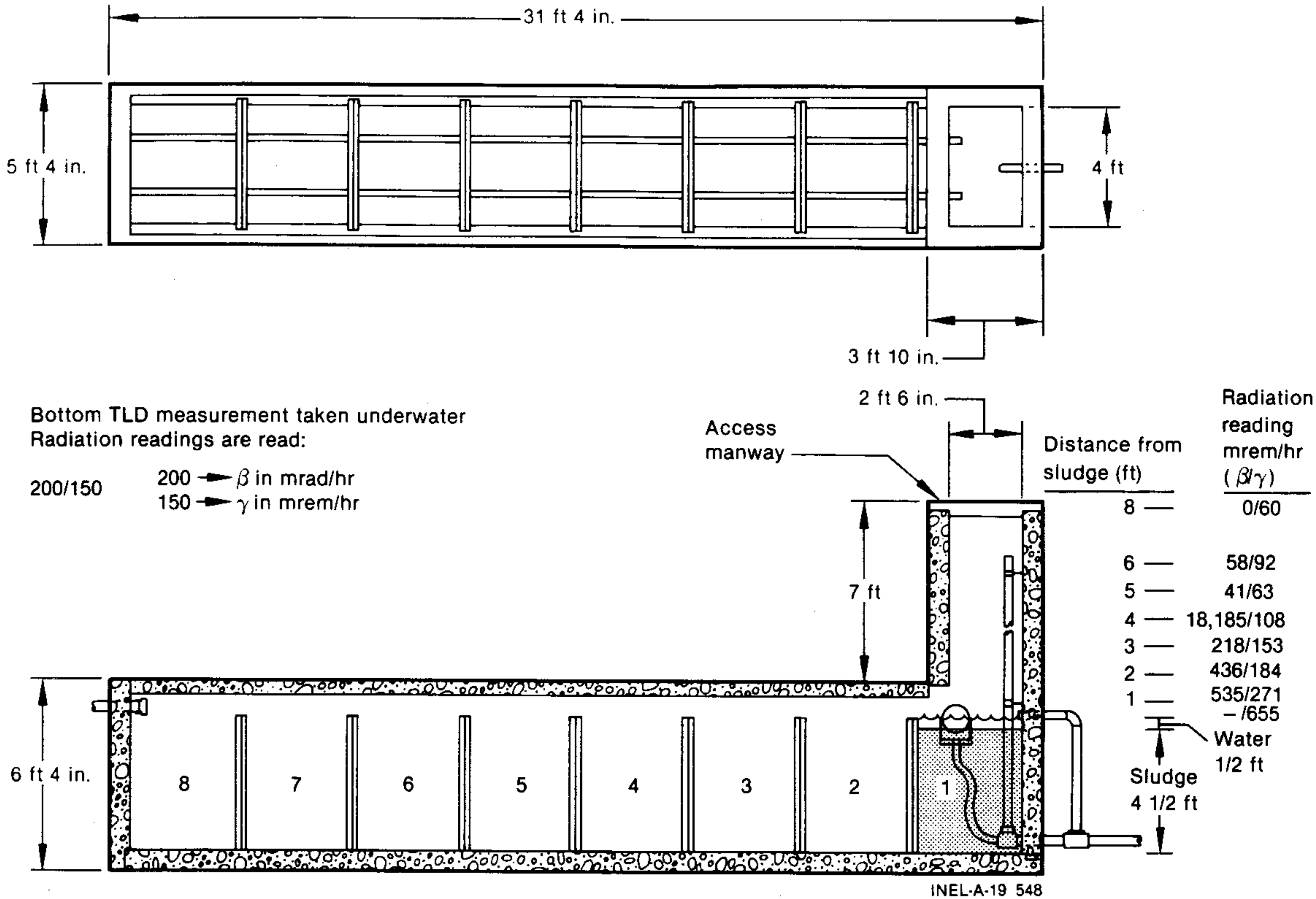

Figure 23. Radiation survey of filter bed.

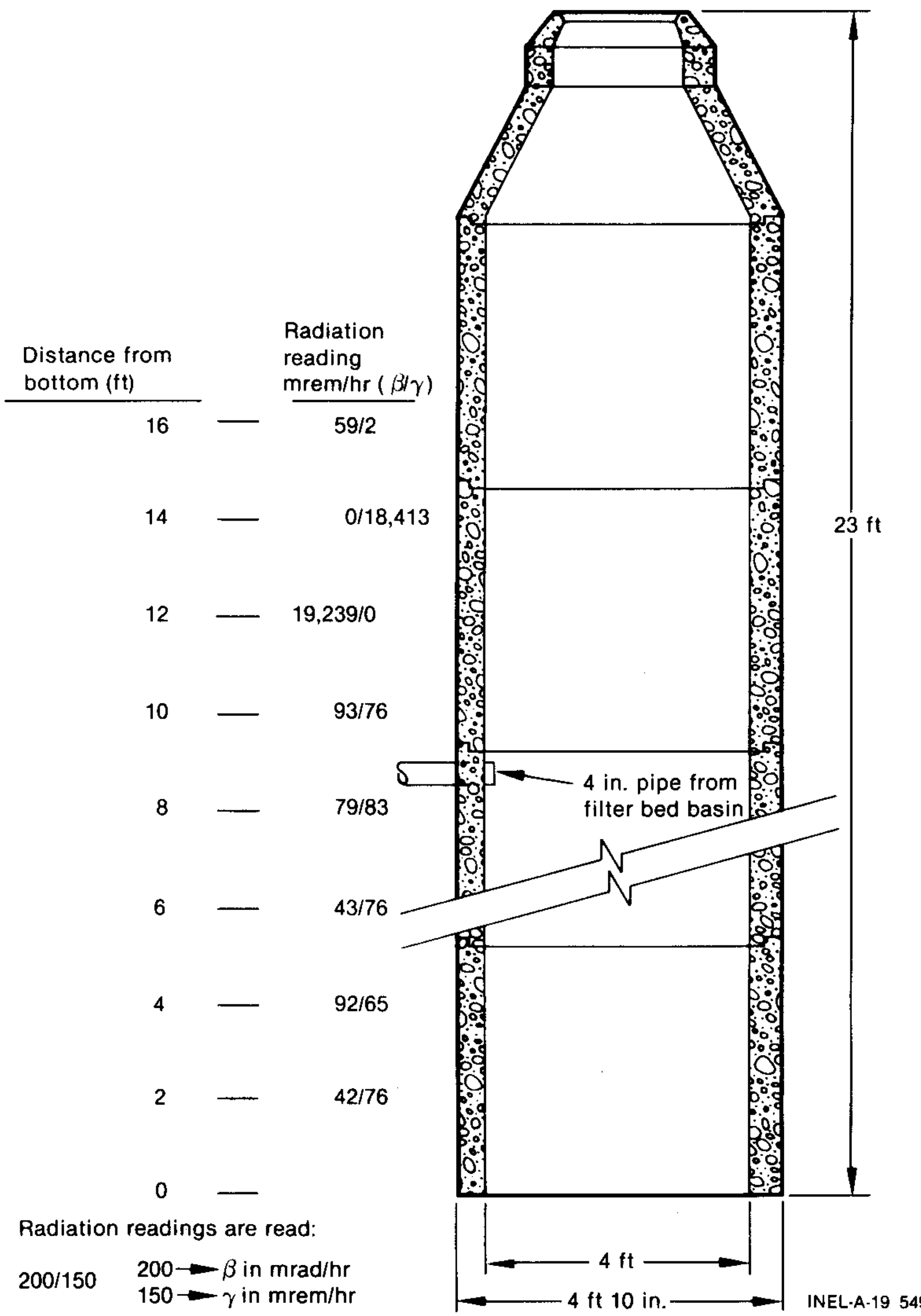

Figure 24. Radiation survey of dry well.

4.3.2 Sludge Radioisotopic Analysis

Material samples taken from the settling facilities and dry well were taken to be analyzed at the ICPP radiochemistry laboratory to determine isotopic content and concentration. The results of the gamma analysis are shown on Table 3. The alpha and beta analyses are shown on Table 4, and the isotropic fissile material assay is on Table 5. From these tables, it is clearly seen that the CPP-301 settling vaults exhibit gamma, beta, and alpha activity in large excess of the rest of the CPP-740 facility, usually in two orders of magnitude of the other component facilities.

4.3.3 Soil Radionuclide Analysis

The soil samples removed from the CPP-740 area were taken to the TRA radiation measurements laboratory for gamma radiation spectrometry analysis and fissile material assaying. The results of the gamma spectrometry analysis had shown seven major gamma ray emmitting isotopes witnin the CPP-740 enclosure soil. They are as follows: Eu-155, Eu-154, Eu-152, Cs-137, Cs-134, Co-60, and Ce-144. Two noteworthy features of the soil activity were the amount of Eu isotopes, which are considered rare in soil samples, and the apparent strength of the Eu activity, which in many cases exceeded that of the Cs-137 activity. The results of the gamma analysis are summarized in Table 6 and are usually shown as a function of depth by Figures 25 to 32.

Figures 25 and 26 show that much of the surface activity is located in the immediate vacinity of the CPP-301 vault access and the dry well manhole. At the 12-inch depth of soil, hot spots exist in the area between the horizontal filter bed and CPP-301, and in the immediate vacinity of the CPP-301 vault access as shown by Figures 27 and 28. The 24-inch depth level had shown only isolated hot spots within the facility enclosure as shown by Figures 29 and 30. At the 36-inch depth level, only "trace" hot spots shown in the vacinity of the CPP-301 vault access and the dry well manhole, as shown by Figures 31 and 32. Considering the magnitude of the gamma activity as a function of depth, Table 6 and the figures show that a

TABLE 3. GAMMA ACTIVITY LEVELS IN CPP SLUDGE (nCi/gm)

Sample	EU-155	EU-154	EU-152	CS-137	CS-134	Co-60	Co-57	Ce-144	Ru-196	Sb-125
Dry Well	0.4054	N/A	0.0946	0.4324	N/A	N/A	N/A	N/A	N/A	N/A
Weir Compt.#1	2.432	0.6486	N/A	55.14	N/A	15.95	N/A	N/A	1.351	N/A
Weir Compt.#2	0.9730	1.545	0.7297	63.78	0.2432	4.946	N/A	0.4865	N/A	N/A
Weir Compt.#5	30.27	70.54	85.95	10.81	1.081	3.811	57.84	107.6	N/A	2.162
Weir Compt.#8	0.4432	1.189	1.459	12.19	0.1649	0.3243	1.014	1.757	N/A	0.0838
CPP 301	362.2	810.8	945.9	3216.0	45.95	191.9	670.3	2243.0	189.2	N/A
BIF Filter	33.24	104.1	118.9	1670.0	18.38	7.027	91.35	56.76	N/A	N/A

Note: N/A - None detected above detection limits.

TABLE 4. ALPHA AND BETA ISOTOPIC CONCENTRATION (pCi/gm)

Sample	Sr-90	Pu-238	Pu-239 240	U-233 234	U-235 236	U-238	Am-241
Dry Well	189.2	<0.540	<0.270	14.32	0.8108	<0.270	<0.1892
Weir Compt. #1	7568	18.92	137.8	10.81	<1.892	13.51	20.81
Weir Compt. #2	12,700	48.65	321.6	10.81	<0.270	0.540	56.76
Weir Compt. #5	6215	18.38	140.5	24.05	1.081	0.297	0.810
Weir[a] Compt. #8	2514	<0.540	10.54	3.784	0.135	0.297	1.622
CPP 301	297,300	2486	13,783	370.3	16.22	<8.108	<13.51
BIF Filter	100,000	60.81	245.9	70.27	2.973	1.351	2.432

a. Weir Compartment #8 results reported as activity per sample because sample was a surface smear.

TABLE 5. FISSILE MATERIAL ASSAY FOR CPP SLUDGE

Sample	Pu-238	Pu-239 240	U-233 234	U-235, 236	U-238	Am-241
Units:	ngm/gm	ngm/gm	ngm/gm	µgm/gm	µgm/gm	pgm/gm
Dry well	.031	.004	2.304	0.379	0.811	0.053
Weir Compt. #1	1.087	2.246	1.739	0.886	40.54	6.420
Weir Compt. #3	2.796	.524	1.739	0.126	1.621	17.51
Weir Compt. #5	1.056	2.290	3.869	0.506	0.892	0.250
Weir Compt. #8	.031	0.172	0.609	0.083	0.892	0.050
CPP 301	142.9	224.6	59.56	7.543	24.32	4.169
BIF Filter	3.495	4.007	11.3	1.392	1.621	0.750

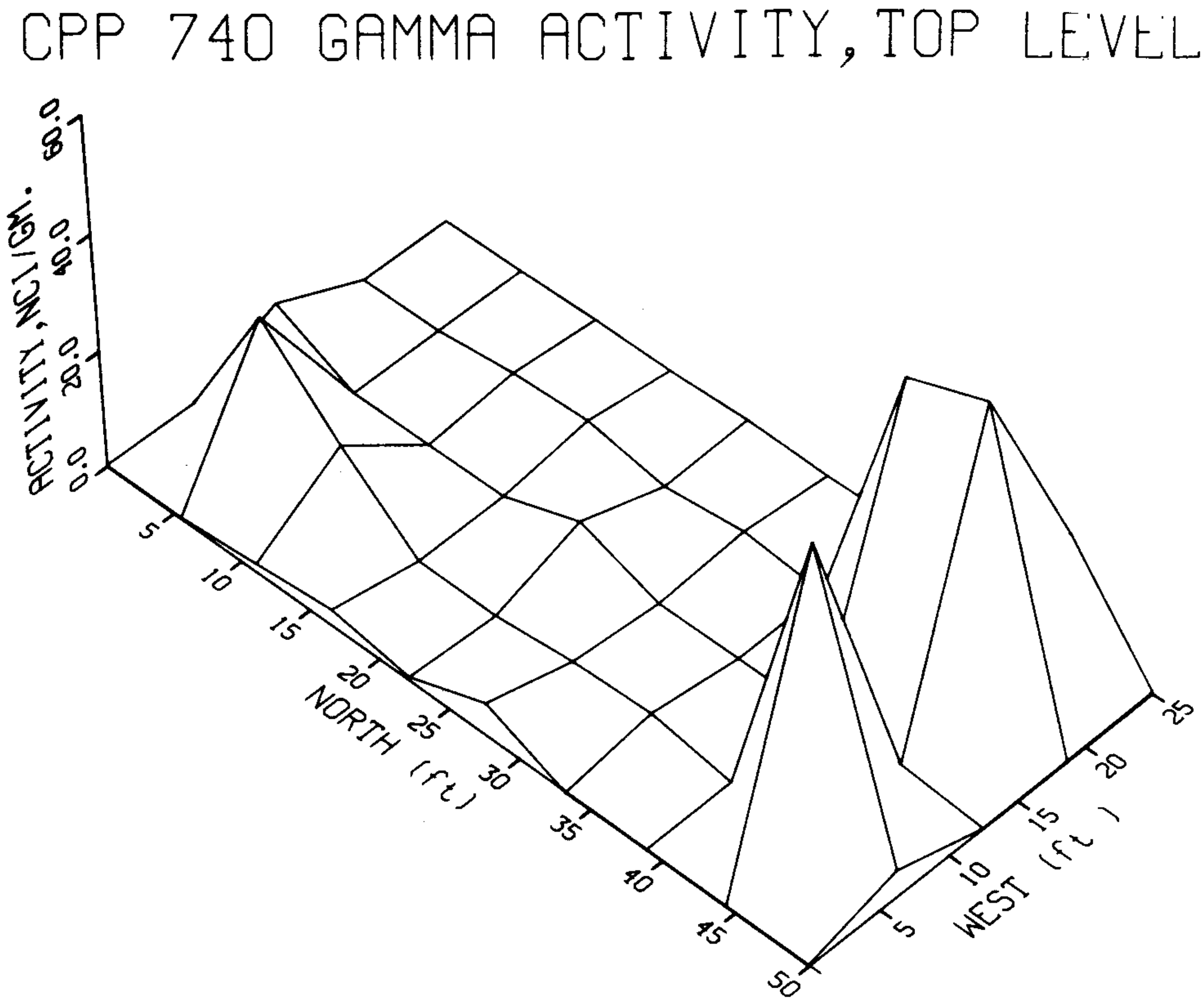

Figure 25. Gamma activity, surface level, looking southeast.

CPP 740 GAMMA ACTIVITY, TOP LEVEL

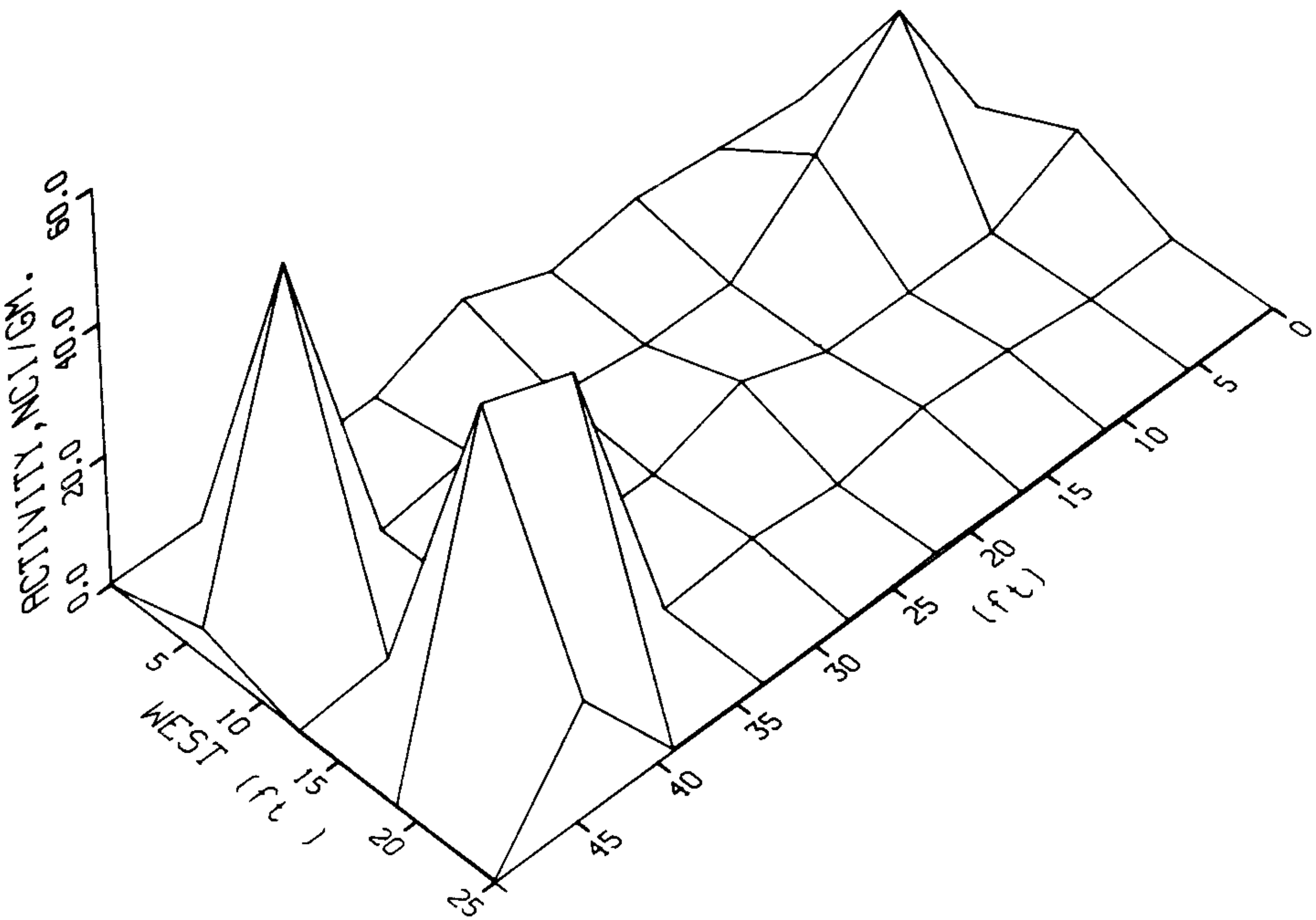

Figure 26. Gamma activity, surface level, looking northeast.

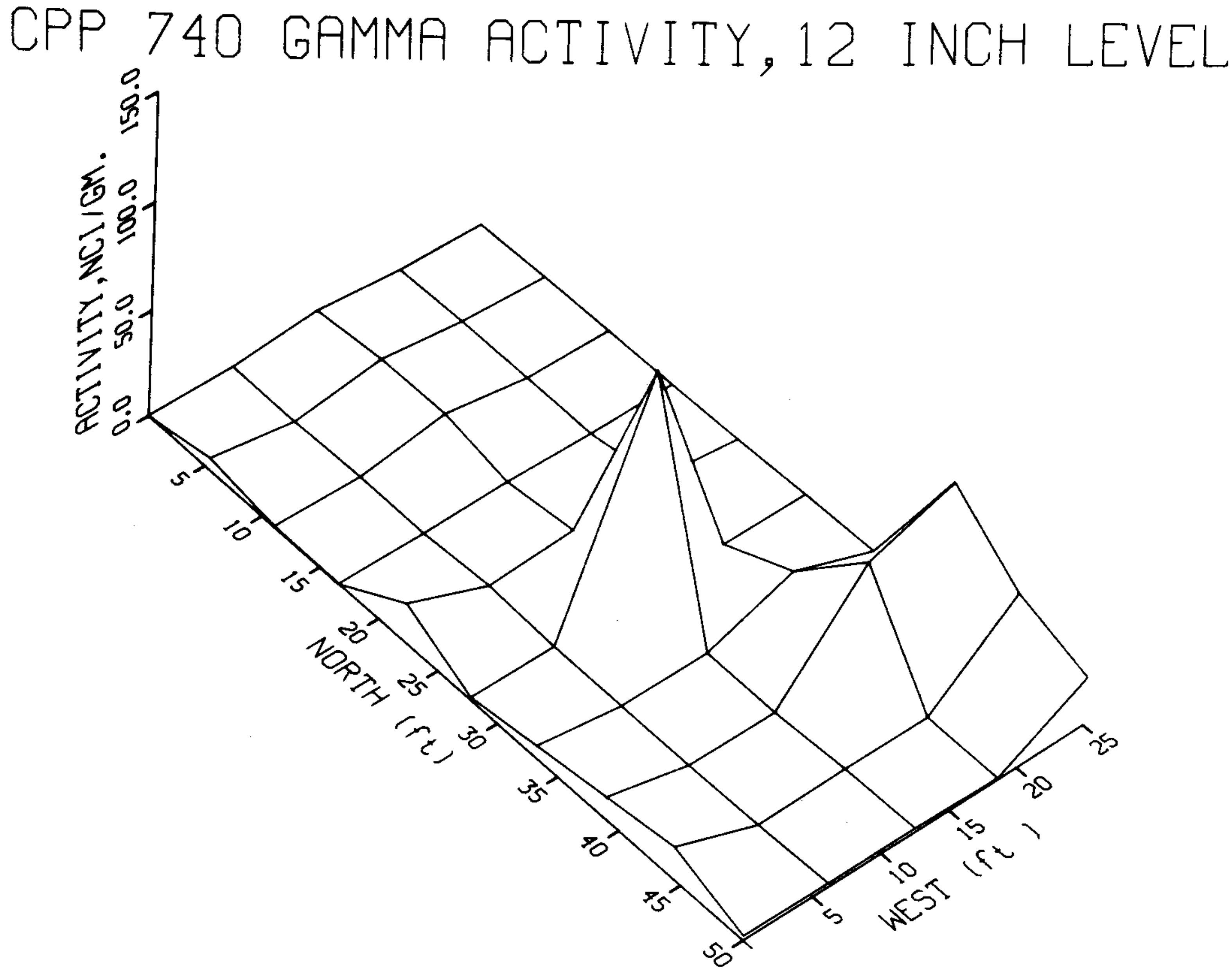

Figure 27. Gamma activity, 12-inch depth, looking southeast.

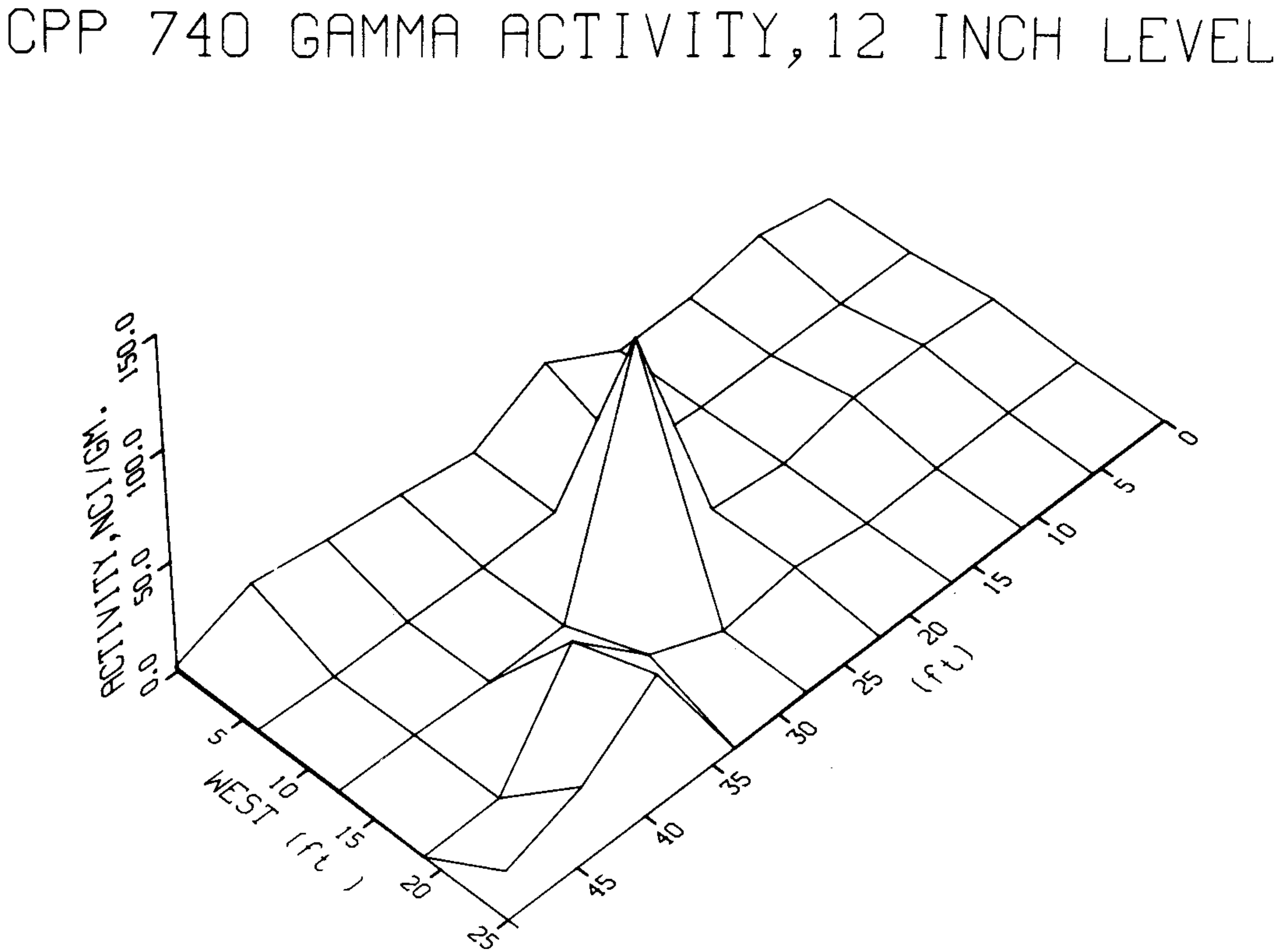

Figure 28. Gamma activity, 12-inch depth, looking northeast.

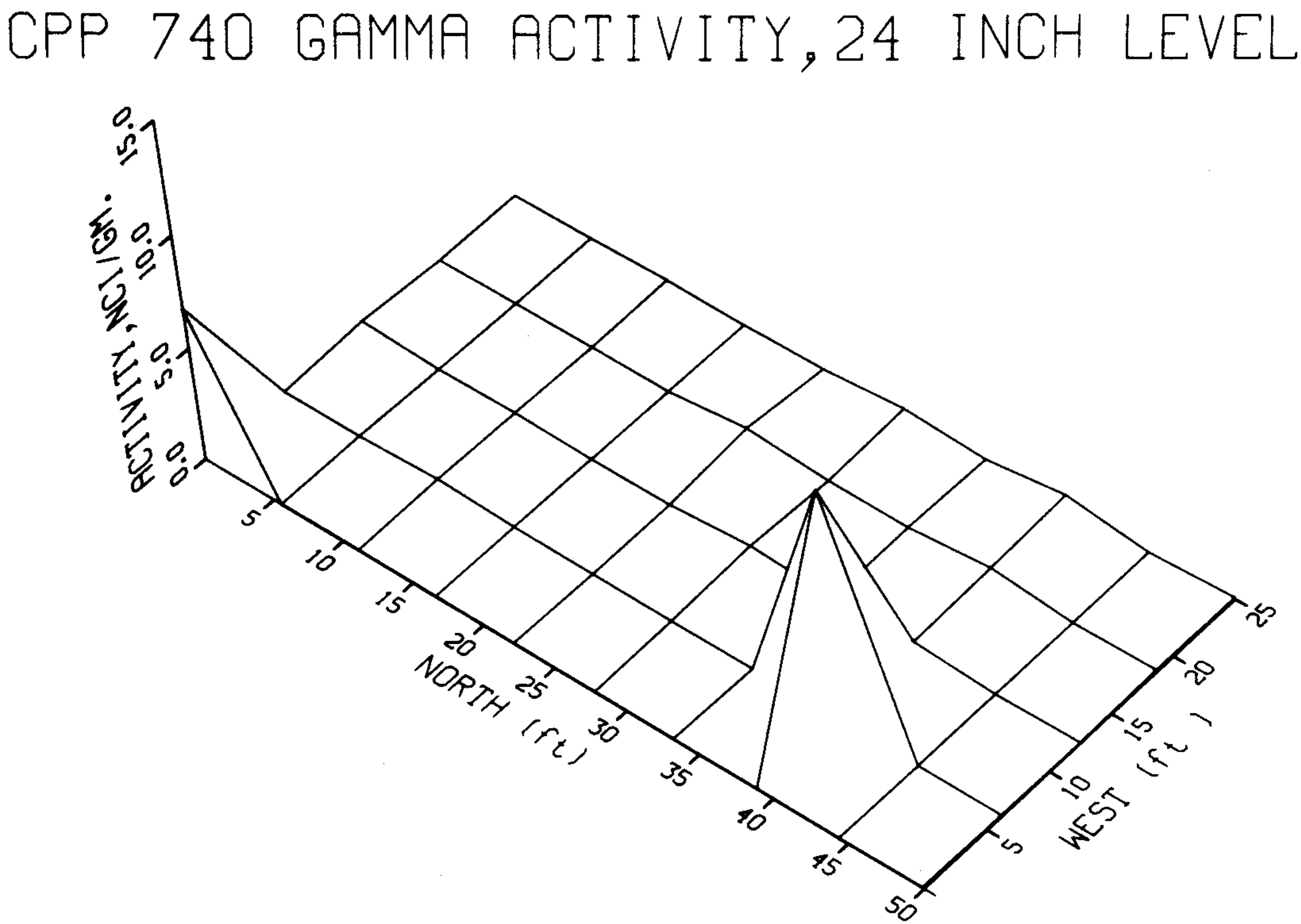

Figure 29. Gamma activity, 24-inch depth, looking southeast.

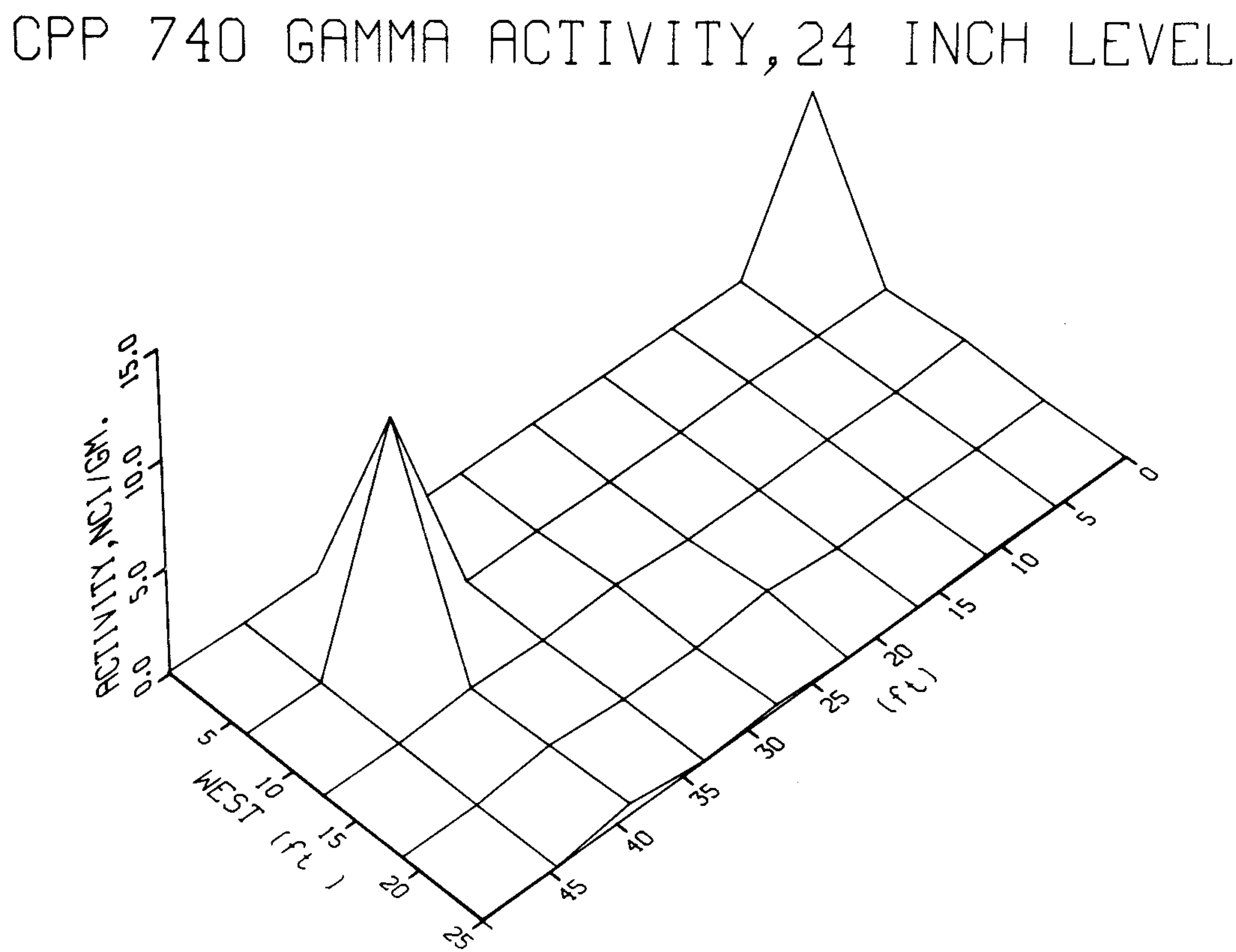

Figure 30. Gamma activity, 24-inch depth, looking northeast.

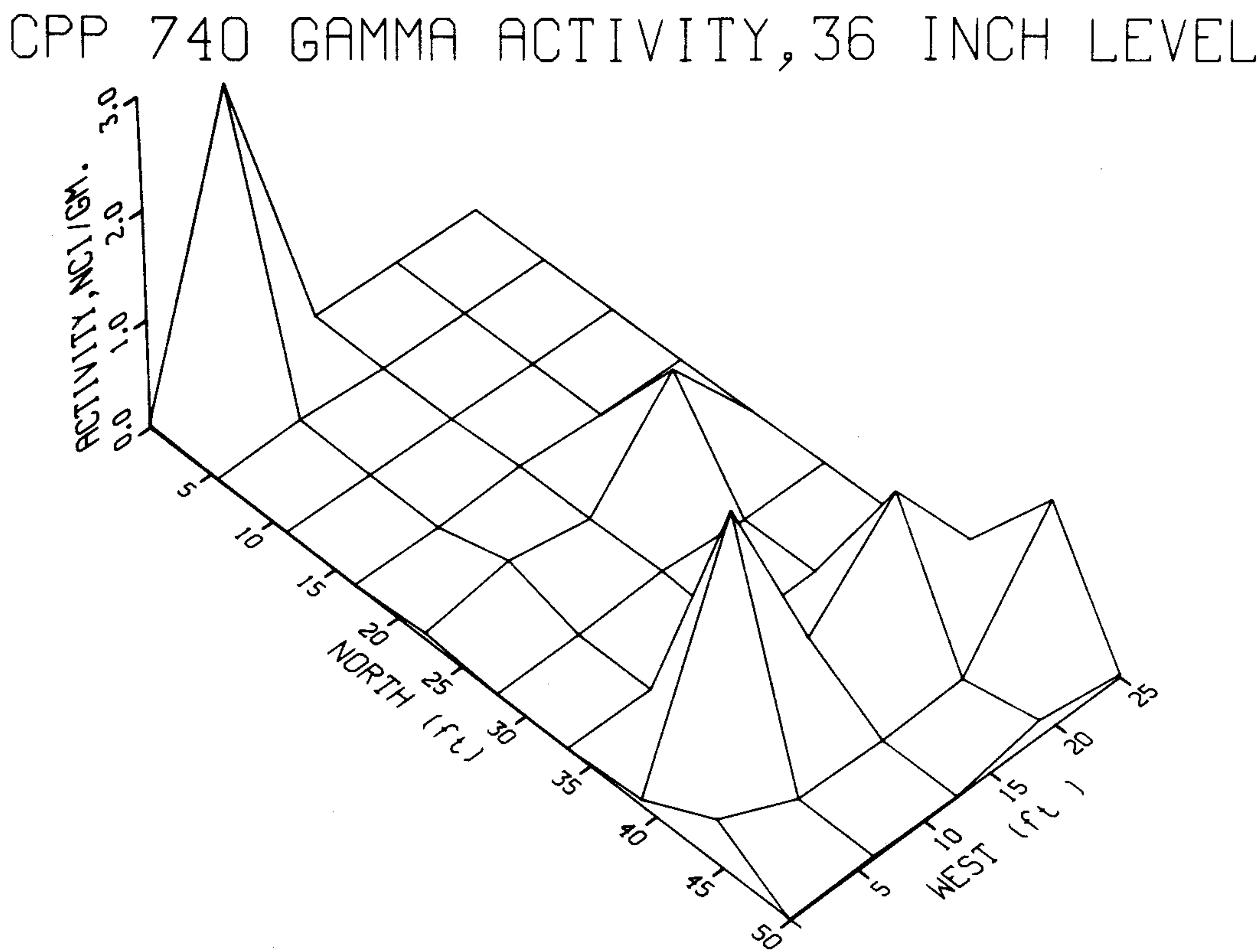

Figure 31. Gamma activity, 36-inch depth, looking southeast.

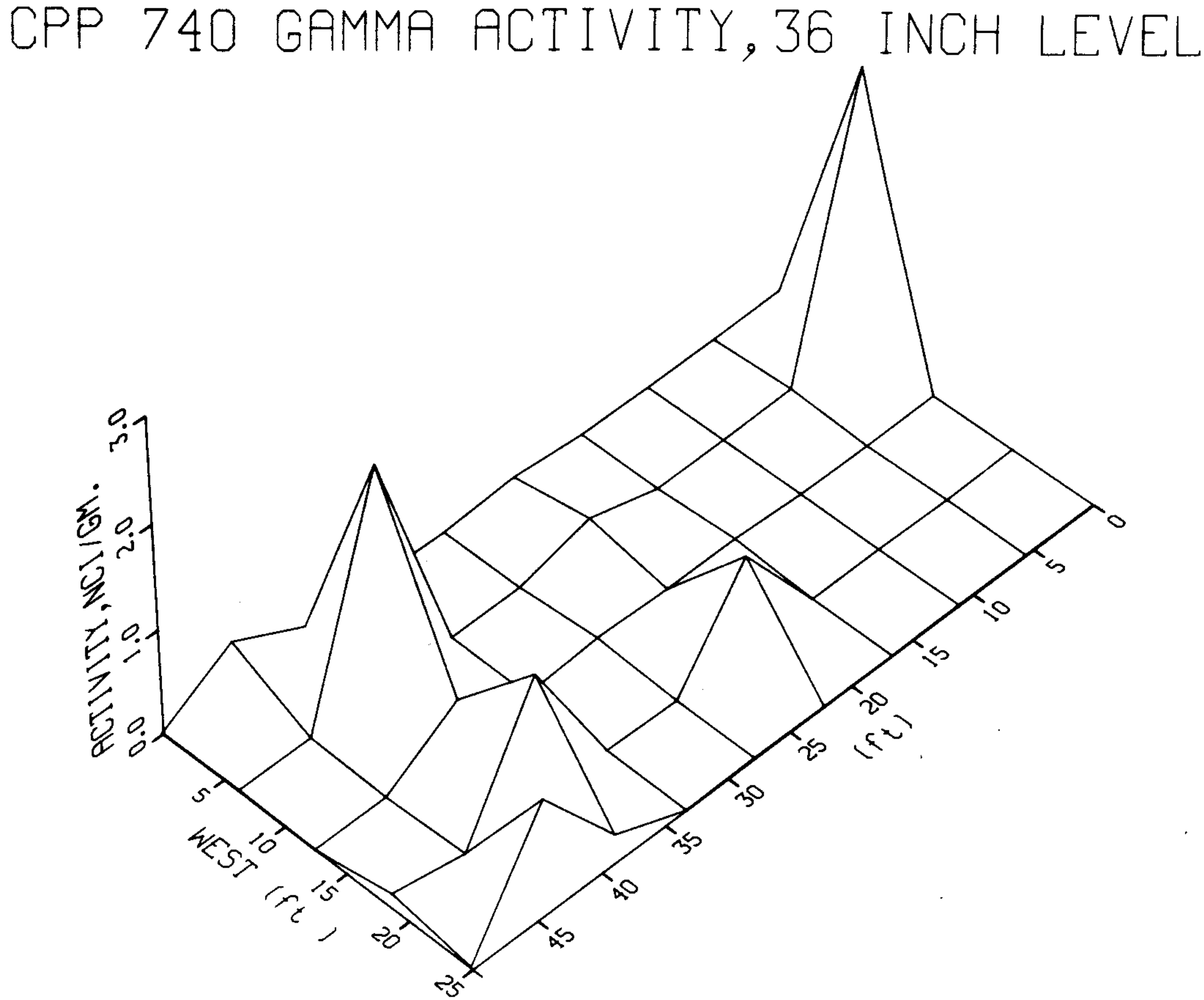

Figure 32. Gamma activity, 36-inch depth, looking northeast.

TABLE 6. GAMMA ACTIVITY LEVELS IN CPP SOIL (nCi/gm)

Sample #	Level (in)	Eu-155	Eu-154	Eu-132	Cs-137	Cs-134	Co-60	Ce-144		Total γ
1	TOP	1.08(-2)	4.92(-2)	4.90(-2)	5.91(-2)	4.28(-4)	2.02(-3)	1.32(-2)		1.83(-1)
	12	<2.0(-4)	1.14(-2)	1.37(-2)	2.45(-2)	3.04(-4)	3.08(-4)	1.88(-3)		5.21(-2)
	24	5.81(-1)	1.97	2.28	1.62	1.82(-2)	7.04(-2)	2.64(-1)		6.80
	36	2.55(-3)	9.05(-3)	9.64(-3)	8.59(-3)	<2.0(-4)	5.49(-4)	1.18(-3)		3.15(-2)
2	TOP	3.51(-3)	1.44(-2)	1.50(-2)	3.35(-2)	<2.0(-4)	5.50(-4)	3.23(-3)		7.02(-2)
	12	1.83(-2)	8.19(-2)	8.32(-2)	1.29(-1)	1.08(-3)	3.61(-3)	1.03(-2)		3.27(-1)
	24	2.85(-4)	5.89(-4)	7.12(-4)	9.65(-4)	<2.0(-4)	2.90(-5)	<2.0(-4)		2.58(-3)
	36	1.22(-1)	5.37(-1)	5.86(-1)	1.30	4.08(-3)	2.49(-2)	6.61(-2)		2.64
3	TOP	3.89(-1)	1.43	1.64	3.07	3.34(-2)	5.03(-2)	1.61(-1)		6.77
	12	3.65(-1)	1.32	1.45	8.04(-1)	8.73(-3)	4.53(-2)	1.50(-1)		4.14
	24	1.95(-2)	7.09(-2)	7.42(-2)	3.66(-2)	<2.0(-4)	2.60(-3)	9.56(-3)		2.13(-1)
	36	1.47(-3)	6.04(-3)	6.00(-3)	2.85(-3)	<2.0(-4)	2.21(-4)	7.35(-4)		1.73(-2)
4	TOP	1.34(-2)	5.82(-2)	5.84(-2)	9.22(-2)	7.04(-4)	2.40(-3)	5.86(-3)		2.31(-1)
	12	5.73(-2)	2.18(-1)	2.39(-1)	2.67(-1)	2.11(-3)	1.01(-2)	2.93(-2)		8.22(-1)
	24	<2.0(-4)	6.11(-4)	5.53(-4)	8.79(-4)	<2.0(-4)	<2.0(-5)	<2.0(-7)		2.04(-3)
	36	1.04(-3)	2.74(-3)	3.32(-3)	5.86(-3)	<2.0(-4)	<2.0(-5)	8.67(-4)		1.38(-2)
5	TOP	4.32(-3)	1.62(-2)	1.73(-2)	3.50(-2)	<2.0(-4)	1.01(-3)	<2.0(-4)		7.38(-2)
	12	2.86(-3)	8.56(-3)	9.82(-3)	5.22(-2)	1.06(-4)	5.79(-4)	2.11(-3)		7.62(-2)
	24	6.42(-4)	2.55(-3)	2.40(-3)	5.36(-3)	<2.0(-4)	1.14(-4)	7.10(-4)		1.17(-2)
	36	4.00(-4)	1.30(-3)	1.27(-3)	2.46(-3)	<2.0(-4)	2.05(-5)	<2.0(-4)		5.45(-3)
6	TOP	1.58(-2)	7.75(-2)	7.88(-2)	8.81(-2)	<2.0(-4)	3.96(-3)	8.52(-3)		2.73(-1)
	12	4.90(-1)	1.99	2.16	1.42	1.23(-2)	6.82(-2)	2.12(-1)		6.35
	24	4.00(-4)	9.48(-4)	7.72(-4)	1.96(-3)	<2.0(-4)	1.24(-5)	<2.0(-4)		4.09(-3)
	36	7.08(-4)	2.86(-3)	3.01(-3)	3.10(-3)	<2.0(-4)	1.05(-5)	<2.0(-4)		9.69(-3)
7	TOP	1.35	7.34	7.16	7.87	7.90(-2)	2.39(-1)	3.03(-2)		24.07
	12	3.14(-3)	1.51(-2)	1.61(-2)	2.32(-2)	<2.0(-4)	5.17(-4)	2.17(-3)		6.01(-2)
	24	1.29(-3)	4.96(-3)	5.26(-3)	8.76(-3)	<2.0(-4)	2.48(-3)	5.69(-4)		2.33(-2)
	36	2.90(-3)	1.26(-2)	1.30(-2)	6.61(-3)	<2.0(-4)	7.68(-4)	2.39(-3)		3.83(-2)

TABLE 6. (cont.) GAMMA ACTIVITY LEVELS IN CPP SOIL (nCi/gm)

Sample #	Level (in)	Eu-155	Eu-154	Eu-152	Cs-137	Cs-134	Co-60	Ce-144		Total γ
8	TOP	1.97(-2)	9.21(-2)	9.40(-2)	1.25(-1)	8.83(-4)	4.07(-3)	9.16(-3)		4.27(-2)
	12	5.31(-1)	2.12	2.31	1.44	1.45(-2)	7.31(-2)	2.10(-1)		6.69
	24	8.31(-4)	2.62(-3)	3.06(-3)	2.59(-3)	<2.0(-4)	3.60(-4)	4.12(-4)		9.87(-3)
	36	1.51(-4)	9.67(-4)	9.22(-4)	3.14(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		5.18(-4)
9	TOP	1.20(-2)	5.28(-2)	5.38(-2)	6.98(-2)	5.00(-4)	1.95(-3)	6.14(-3)		1.96(-1)
	12	1.08(-1)	5.16(-1)	5.17(-1)	4.42(-1)	3.98(-3)	2.42(-2)	5.11(-2)		1.66
	24	<2.0(-4)	8.96(-4)	5.76(-4)	4.85(-4)	<2.0(-4)	<2.0(-5)	<2.0(-4)		1.96(-3)
	36	2.13(-4)	5.44(-4)	7.20(-4)	8.79(-4)	<2.0(-4)	<2.0(-5)	2.45(-4)		2.60(-3)
10	TOP	<2.0(-4)	1.33(-3)	1.94(-3)	1.60(-3)	<2.0(-4)	9.10(-5)	9.11(-4)		5.87(-3)
	12	6.00(-3)	2.80(-2)	2.86(-2)	9.55(-2)	6.29(-4)	1.97(-3)	<2.0(-4)		1.60(-1)
	24	2.24(-4)	<2.0(-4)	2.93(-4)	4.84(-4)	<2.0(-4)	<2.0(-5)	<2.0(-4)		1.00(-3)
	36	<2.0(-4)	<2.0(-4)	<2.0(-4)	4.13(-4)	<2.0(-4)	<2.0(-5)	<2.0(-4)		4.13(-4)
11	TOP	1.21(-1)	4.89(-1)	5.12(-1)	2.99(-1)	2.78(-3)	1.77(-2)	5.13(-2)		1.49
	12	4.47(-2)	2.10(-1)	2.07(-1)	2.04(-1)	1.94(-3)	9.78(-3)	1.98(-2)		6.97(-1)
	24	8.74(-4)	2.81(-3)	2.56(-3)	3.20(-3)	<2.0(-4)	<2.0(-5)	5.52(-4)		9.99(-3)
	36	4.75(-4)	<2.0(-4)	5.38(-4)	1.78(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		2.79(-3)
12	TOP	7.51(-1)	3.08	3.34	3.37	3.52(-2)	1.04(-1)	3.26(-1)		11.01
	12	9.86(-3)	4.54(-2)	4.54(-2)	6.70(-2)	<2.0(-4)	2.21(-3)	5.23(-3)		1.75(-1)
	24	1.10(-2)	4.36(-2)	4.61(-2)	1.45(-2)	<2.0(-4)	1.29(-3)	5.29(-3)		1.21(-1)
	36	5.96(-4)	1.42(-3)	1.54(-3)	3.19(-3)	<2.0(-4)	<2.0(-5)	4.15(-4)		7.16(-3)
13	TOP	3.38(-3)	1.51(-2)	1.50(-2)	2.44(-2)	2.13(-4)	8.62(-4)	2.38(-3)		6.13(-2)
	12	3.97(-1)	1.70	1.82	2.46	2.47(-2)	6.44(-2)	1.88(-1)		6.65
	24	5.07(-3)	1.74(-2)	2.03(-2)	1.91(-2)	<2.0(-4)	1.06(-3)	2.09(-3)		6.55(-2)
	36	<2.0(-4)	1.29(-3)	1.52(-3)	3.09(-3)	<2.0(-4)	1.11(-4)	<2.0(-4)		6.01(-3)
14	TOP	6.07(-2)	2.12(-1)	2.41(-1)	1.17	1.21(-2)	1.04(-2)	4.98(-2)		1.76
	12	4.32(-2)	1.68(-1)	1.79(-1)	1.79(-1)	1.67(-3)	8.63(-3)	2.29(-2)		6.02(-1)
	24	<2.0(-4)	1.48(-3)	1.71(-3)	1.63(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		4.82(-3)
	36	<2.0(-4)	<2.0(-4)	<2.0(-4)	2.45(-3)	<2.0(-4)	2.0(-5)	<2.0(-4)		2.45(-3)

TABLE 6 (cont.) GAMMA ACTIVITY LEVELS IN CPP SOIL (nCi/gm)

Sample #	Level (in)	Eu-155	Eu-154	Eu-152	Cs-137	Cs-134	Co-60	Ce-144		Total γ
15	TOP	1.86(-2)	7.30(-2)	7.88(-2)	1.60(-1)	1.17(-3)	3.66(-3)	1.14(-2)		3.46(-1)
	12	1.07(-3)	4.78(-3)	4.35(-3)	1.28(-2)	<2.0(-4)	2.82(-4)	9.66(-4)		2.42(-2)
	24	3.30(-3)	1.29(-2)	1.33(-2)	4.52(-2)	<2.0(-4)	1.72(-3)	1.49(-3)		7.79(-2)
	36	<2.0(-4)	<2.0(-4)	6.42(-4)	1.58(-3)	<2.0(-4)	3.81(-5)	<2.0(-4)		2.26(-3)
16	TOP	1.76(-1)	8.32(-1)	8.50(-1)	9.37(-1)	1.05(-2)	2.99(-2)	9.86(-2)		2.93
	12	8.56(-3)	3.72(-2)	3.77(-2)	5.44(-2)	<2.0(-4)	1.48(-3)	4.60(-3)		1.44(-1)
	24	1.22(-3)	3.93(-3)	3.78(-3)	3.45(-3)	<2.0(-4)	1.99(-4)	2.86(-3)		1.54(-2)
	36	7.21(-4)	2.01(-3)	2.44(-3)	3.57(-3)	<2.0(-4)	1.28(-4)	<2.0(-4)		8.87(-3)
17	TOP	1.06(-2)	4.05(-2)	4.26(-2)	4.59(-2)	<2.0(-4)	1.51(-3)	5.49(-3)		1.46(-1)
	12	2.14(-3)	9.93(-3)	9.50(-3)	2.61(-2)	2.30(-4)	3.96(-4)	1.94(-3)		5.02(-2)
	24	2.20(-3)	8.44(-3)	8.15(-3)	1.37(-2)	<2.0(-4)	5.65(-4)	2.73(-3)		3.58(-2)
	36	5.90(-4)	2.30(-3)	2.07(-3)	3.11(-3)	<2.0(-4)	2.0(-5)	<2.0(-4)		7.87(-3)
18	TOP	9.53(-3)	6.80(-2)	5.84(-2)	1.55(-1)	1.24(-3)	3.79(-3)	8.09(-3)		3.04(-1)
	12	4.81(-2)	2.36(-1)	2.25(-1)	1.40(-1)	1.50(-3)	1.07(-2)	3.27(-2)		6.64(-1)
	24	4.83(-4)	2.04(-3)	2.00(-3)	4.57(-3)	<2.0(-4)	1.14(-4)	<2.0(-4)		9.20(-3)
	36	3.20(-3)	1.43(-2)	1.38(-2)	1.73(-2)	<2.0(-4)	6.73(-4)	1.94(-3)		5.12(-2)
19	TOP	1.51(-1)	7.09(-1)	7.11(-1)	8.11(-1)	7.20(-3)	3.26(-2)	7.20(-2)		2.49
	12	2.07(-3)	6.38(-3)	7.04(-3)	8.14(-3)	<2.0(-4)	4.35(-4)	<2.0(-4)		2.41(-2)
	24	<2.0(-4)	<2.0(-4)	4.16(-4)	7.36(-3)	<2.0(-4)	4.42(-5)	<2.0(-4)		7.82(-3)
	36	5.38(-5)	1.01(-3)	6.97(-4)	3.90(-3)	<2.0(-4)	5.78(-5)	<2.0(-4)		5.66(-3)
20	TOP	<2.0(-4)	9.41(-2)	9.59(-2)	1.13(-1)	8.46(-4)	4.01(-3)	<2.0(-4)		3.08(-1)
	12	1.80(-3)	6.48(-3)	6.51(-3)	1.43(-2)	<2.0(-4)	3.33(-4)	8.13(-4)		3.02(-2)
	24	<2.0(-4)	<2.0(-4)	9.73(-4)	1.23(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		2.20(-3)
	36	<2.0(-4)	<2.0(-4)	3.15(-4)	2.20(-4)	<2.0(-4)	<2.0(-5)	<2.0(-4)		3.15(-4)
21	TOP	4.35(-2)	2.15(-1)	2.09(-1)	2.47(-1)	2.58(-3)	8.32(-3)	2.03(-2)		7.45(-1)
	12	1.19	4.92	5.22	6.20	5.84(-2)	1.84(-1)	5.24(-1)		18.29
	24	4.44(-3)	1.59(-2)	1.69(-2)	1.18(-2)	1.57(-4)	9.85(-4)	4.55(-3)		5.46(-2)
	36	6.43(-4)	2.09(-3)	1.55(-3)	2.16(-3)	<2.0(-4)	3.03(-5)	<2.0(-4)		6.44(-3)

TABLE 6. (cont.) GAMMA ACTIVITY LEVELS IN CPP SOIL (nCi/gm)

Sample #	Level (in)	Eu-155	Eu-154	Eu-152	Cs-137	Cs-134	Co-60	Ce-144		Total γ
22	TOP	6.28(-4)	1.73(-3)	1.82(-3)	5.65(-3)	<2.0(-4)	2.34(-4)	<2.0(-4)		1.01(-2)
	12	1.49(-1)	7.28(-1)	7.05(-1)	5.61(-1)	4.85(-3)	3.43(-2)	6.99(-2)		2.25
	24	<2.0(-4)	<2.0(-4)	2.79(-4)	5.25(-4)	<2.0(-4)	<2.0(-5)	<2.0(-4)		8.04(-4)
	36	1.18(-2)	5.25(-2)	5.55(-2)	5.61(-2)	3.08(-4)	2.26(-3)	1.62(-2)		1.95(-1)
23	TOP	3.37(-1)	1.44	1.66	1.52	1.38(-2)	5.83(-2)	1.41(-1)		5.17
	12	2.93(-1)	1.37	1.32	1.12	9.18(-3)	6.51(-2)	1.57(-1)		4.33
	24	6.93(-4)	3.16(-3)	2.55(-3)	2.96(-3)	<2.0(-4)	4.61(-4)	6.08(-4)		1.04(-2)
	36	3.58(-3)	1.58(-2)	1.65(-2)	7.56(-3)	<2.0(-4)	1.14(-3)	3.37(-3)		4.79(-2)
24	TOP	7.26(-3)	3.86(-2)	3.66(-2)	6.96(-2)	7.07(-4)	1.94(-3)	4.21(-3)		1.59(-1)
	12	3.35(-1)	1.51	1.53	1.21	1.30(-2)	6.39(-2)	1.37(-1)		4.79
	24	1.81(-2)	9.72(-2)	9.70(-2)	1.44(-1)	1.35(-3)	4.29(-3)	8.80(-3)		3.71(-1)
	36	7.56(-2)	2.65(-1)	2.89(-1)	2.25(-1)	1.93(-3)	1.32(-2)	3.48(-2)		9.04(-1)
25	TOP	4.76(-2)	1.89(-1)	2.08(-1)	2.39(-1)	2.26(-3)	7.62(-3)	2.11(-2)		7.14(-1)
	12	6.56(-4)	2.15(-3)	2.31(-3)	4.25(-3)	<2.0(-4)	1.17(-4)	<2.0(-4)		9.48(-3)
	24	<2.0(-4)	<2.0(-4)	2.02(-4)	2.19(-4)	<2.0(-4)	<2.0(-5)	<2.0(-4)		4.21(-4)
	36	<2.0(-4)	6.45(-4)	4.14(-4)	3.35(-4)	7.50(-5)	3.41(-5)	<2.0(-4)		1.50(-3)
26	TOP	3.76(-1)	1.77	1.81	1.67	1.80(-2)	6.44(-2)	1.67(-1)		5.87
	12	1.05(-1)	4.30(-1)	4.33(-1)	3.20(-1)	2.87(-3)	1.62(-2)	5.28(-2)		1.36
	24	5.44(-4)	2.28(-3)	2.10(-3)	1.45(-3)	<2.0(-4)	2.49(-4)	<2.0(-4)		6.62(-3)
	36	2.88(-4)	6.90(-4)	9.62(-4)	2.61(-3)	<2.0(-4)	4.27(-5)	<2.0(-4)		4.59(-3)
27	TOP	9.08(-2)	4.67(-1)	4.59(-1)	4.91(-1)	5.45(-3)	2.07(-2)	4.68(-2)		1.58
	12	4.28(-2)	1.77(-1)	1.94(-1)	1.46(-1)	8.23(-4)	7.56(-3)	2.07(-2)		5.88(-1)
	24	4.38(-4)	1.27(-3)	1.24(-3)	1.70(-3)	<2.0(-4)	2.30(-4)	<2.0(-4)		4.88(-3)
	36	3.30(-4)	6.34(-4)	9.89(-4)	3.18(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		5.13(-3)
28	TOP	1.70(-2)	8.07(-2)	8.72(-2)	1.10(-1)	9.87(-4)	3.60(-3)	1.02(-2)		3.09(-1)
	12	7.60	32.2	35.0	26.5	2.26(-1)	1.45	2.39		105.37
	24	1.80(-2)	7.50(-2)	7.64(-2)	6.58(-2)	<2.0(-4)	3.73(-3)	<2.0(-4)		2.39(-1)
	36	3.90(-3)	1.48(-2)	1.72(-2)	1.85(-2)	1.65(-4)	9.72(-4)	3.05(-3)		5.85(-2)

TABLE 6. (cont.) GAMMA ACTIVITY LEVELS IN CPP SOIL (nCi/gm)

Sample #	Level (in)	Eu-155	Eu-154	Eu-152	Cs-137	Cs-134	Co-60	Ce-144		Total γ
29	TOP	9.73(-2)	3.92(-1)	4.28(-1)	5.77(-1)	6.20(-3)	1.54(-2)	4.30(-2)		1.56
	12	3.48(-2)	1.45(-1)	1.44(-1)	1.82(-1)	1.55(-3)	6.24(-3)	1.52(-2)		5.28(-1)
	24	4.06(-3)	1.75(-2)	1.79(-2)	1.77(-2)	<2.0(-4)	2.11(-3)	<2.0(-4)		5.92(-2)
	36	<2.0(-4)	1.37(-3)	2.38(-3)	7.02(-3)	<2.0(-4)	1.28(-4)	<2.0(-4)		1.09(-3)
30	TOP	3.01(-3)	1.57(-2)	1.59(-2)	3.83(-2)	<2.0(-4)	6.43(-4)	1.69(-3)		7.52(-2)
	12	1.36(-2)	5.53(-2)	5.63(-2)	3.82(-2)	<2.0(-4)	4.49(03)	6.81(-3)		1.75(-1)
	24	1.14(-2)	9.03(-2)	1.01(-1)	2.27(-2)	<2.0(-4)	3.94(-3)	1.14(-2)		2.41(-1)
	36	3.98(-4)	5.31(-4)	5.97(-4)	4.35(-4)	<2.0(-4)	<2.0(-5)	<2.0(-4)		1.96(-3)
31	TOP	3.32(-3)	1.64(-2)	1.52(-2)	2.26(-2)	<2.0(-4)	4.31(-4)	2.16(-3)		6.01(-2)
	12	4.49(-1)	2.13	2.05	1.50	1.79(-2)	7.58(-2)	1.90(-1)		6.41
	24	2.48(-3)	1.11(-2)	1.09(-2)	9.47(-3)	<2.0(-4)	6.35(-4)	1.27(-3)		5.82(-2)
	36	<2.0(-4)	2.19(-3)	2.16(-3)	7.05(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		1.14(-2)
32	TOP	1.51(-1)	6.36(-1)	6.42(-1)	7.55(-1)	5.09(-3)	3.26(-2)	6.77(-2)		2.29
	12	3.07(-4)	2.10(-3)	9.97(-4)	5.63(-3)	<2.0(-4)	1.85(-4)	<2.0(-4)		9.22(-3)
	24	1.48(-4)	<2.0(-4)	<2.0(-4)	6.02(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		6.17(-3)
	36	5.62(-4)	<2.0(-4)	4.82(-4)	3.47(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		4.51(-3)
33	TOP	1.26(-2)	5.93(-2)	5.98(-2)	9.02(-2)	6.35(-4)	3.13(-3)	5.75(-3)		2.26(-1)
	12	2.58(-2)	9.38(-2)	1.05(-1)	3.31(-1)	9.24(-4)	6.03(-3)	9.10(-3)		5.71(-1)
	24	2.24(-4)	8.66(-4)	7.86(-4)	5.10(-3)	<2.0(-4)	1.02(-4)	<2.0(-4)		7.08(-3)
	36	<2.0(-4)	<2.0(-4)	3.10(-4)	3.35(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		3.66(-3)
34	TOP	2.38(-2)	1.09(-1)	1.14(-1)	1.33(-1)	9.52(-4)	4.27(-3)	9.85(-3)		3.95(-1)
	12	6.54(-1)	3.06	3.08	7.51	6.15(-2)	1.43(-1)	2.85(-1)		14.79
	24	2.30(-3)	8.90(-3)	9.19(-3)	2.60(-2)	<2.0(-4)	7.58(-4)	1.20(-3)		4.83(-2)
	36	1.11(-3)	3.48(-3)	3.91(-3)	6.90(-3)	<2.0(-4)	4.07(-4)	<2.0(-4)		1.58(-2)
35	TOP	9.40(-3)	3.94(-2)	4.00(-2)	1.45(-1)	5.26(-4)	2.67(-3)	<2.0(-4)		2.37(-1)
	12	1.20(-3)	1.26(-3)	1.53(-3)	5.13(-3)	<2.0(-4)	7.42(-5)	<2.0(-4)		9.19(-3)
	24	<2.0(-4)	9.27(-4)	1.17(-3)	2.94(-3)	<2.0(-4)	3.59(-5)	<2.0(-4)		5.04(-3)
	36	<2.0(-4)	<2.0(-4)	<2.0(-4)	1.01(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		1.01(-3)

TABLE 6. (cont.) GAMMA ACTIVITY LEVELS IN CPP SOIL (nCi/gm)

Sample #	Level (in)	Eu-155	Eu-154	Eu-152	Cs-137	Cs-134	Co-60	Ce-144	Total γ
36	TOP	7.29(-4)	2.65(-3)	2.78(-3)	1.44(-2)	<2.0(-4)	1.51(-4)	9.46(-4)	2.16(-2)
	12	7.03(-1)	3.10	3.27	2.89	1.99(-2)	1.18(-1)	2.99(-1)	10.40
	24	3.01(-4)	5.92(-4)	1.06(-3)	5.64(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)	7.59(-3)
	36	3.92(-3)	1.46(-2)	1.66(-2)	1.82(-2)	<2.0(-4)	1.07(-3)	1.44(-3)	5.58
37	TOP	7.83(-4)	2.78(-3)	2.98(-3)	5.02(-3)	<2.0(-4)	3.60(-4)	<2.0(-4)	1.19(-2)
	12	1.49(-3)	7.72(-4)	6.24(-4)	2.17(-3)	<2.0(-4)	1.84(-5)	<2.0(-4)	5.07(-3)
	24	6.31(-1)	2.83	2.97	3.19	2.18(-2)	1.25(-1)	2.71(-1)	10.04
	36	1.42(-1)	5.81(-1)	6.32(-1)	6.94(-1)	4.10(-3)	2.78(-2)	5.84(-2)	2.14
38	TOP	5.77(-4)	2.49(-3)	1.90(-3)	5.30(-3)	<2.0(-4)	2.71(-4)	<2.0(-4)	1.05(-2)
	12	3.95(-4)	1.02(-3)	9.12(-4)	6.01(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)	8.34(-3)
	24	9.43(-3)	5.12(-2)	4.86(-2)	6.89(-2)	6.08(-4)	2.26(-3)	3.96(-3)	1.84(-1)
	36	5.58(-3)	2.76(-2)	2.93(-2)	3.79(-1)	1.94(-4)	2.45(-3)	4.82(-3)	4.49(-1)
39	TOP	2.96	12.31	13.5	15.5	6.08(-2)	4.92(-1)	1.40	46.22
	12	3.55(-1)	1.59	1.67	3.80	1.27(-2)	8.12(-2)	1.66(-1)	7.67
	24	2.18(-2)	9.50(-2)	1.01(-1)	9.24(-2)	<2.0(-4)	5.88(-3)	1.93(-2)	3.35(-1)
	36	4.71(-3)	1.47(-2)	1.80(-2)	1.21	4.03(-4)	1.59(-3)	3.96(-3)	1.25
40	TOP	6.24(-3)	2.55(-2)	2.72(-2)	4.37(-2)	<2.0(-4)	1.26(-3)	2.73(-3)	1.06(-1)
	12	4.27	19.2	20.1	13.0	1.22(-1)	8.78(-1)	1.68	59.25
	24	1.41(-2)	5.92(-2)	6.03(-2)	3.35(-1)	3.58(-4)	4.43(-3)	9.74(-3)	4.83(-1)
	36	2.23(-2)	8.57(-2)	8.76(-2)	5.80(-2)	<2.0(-4)	3.51(-3)	1.69(-2)	2.74(-1)
41	TOP	2.28(-3)	7.86(-3)	8.09(-3)	3.44(-2)	2.47(-4)	3.20(-4)	9.75(-4)	5.42(-2)
	12	8.95(-1)	5.04	4.93	3.95	3.62(-2)	2.19(-1)	3.74(-1)	15.44
	24	8.61(-4)	3.03(-3)	3.59(-3)	1.01(-2)	<2.0(-4)	1.04(-4)	<2.0(-4)	1.77(-2)
	36	2.90(-2)	1.28(-1)	1.36(-1)	8.81(-2)	8.26(-4)	6.02(-3)	1.29(-2)	4.00(-1)
42	TOP	3.52	14.3	15.5	15.1	1.33(-1)	6.20(-1)	1.21	50.38
	12	7.59(-3)	3.10(-2)	3.22(-2)	2.76(-2)	<2.0(-4)	1.43(-3)	3.45(-3)	1.03(-1)
	24	1.10(-3)	3.08(-3)	3.12(-3)	9.23(-3)	4.07(-4)	<2.0(-5)	<2.0(-4)	1.69(-2)
	36	1.83(-3)	5.39(-3)	6.05(-3)	6.43(-3)	<2.0(-4)	1.75(-4)	1.57(-3)	2.14(-2)

TABLE 6. (cont.) GAMMA ACTIVITY LEVELS IN CPP SOIL (nCi/gm)

Sample #	Level (in)	Eu-155	Eu-154	Eu-152	Cs-137	Cs-134	Co-60	Ce-144		Total γ
43	TOP	5.66(-2)	3.40(-1)	2.96(-1)	4.92(-1)	4.77(-3)	1.30(-2)	2.85(-2)		1.23
	12	8.97(-2)	3.34(-1)	3.61(-1)	5.43(-1)	3.38(-3)	1.44(-2)	4.36(-2)		1.39
	24	<2.0(-4)	2.62(-3)	2.81(-3)	3.25(-3)	<2.0(-4)	2.22(-4)	<2.0(-4)		8.90(-3)
	36	3.47(-4)	1.54(-3)	1.23(-3)	2.96(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		6.07(-3)
44	TOP	2.62	11.2	12.1	23.5	1.52(-1)	5.75(-1)	1.13		51.27
	12	3.13(-2)	1.28(-1)	1.28(-1)	3.59(-1)	<2.0(-4)	8.77(-3)	2.27(-2)		6.77(-1)
	24	5.37(-3)	2.14(-2)	2.31(-2)	3.49(-2)	<2.0(-4)	1.42(-3)	2.15(-3)		8.83(-3)
	36	1.67(-3)	5.47(-3)	5.50(-3)	1.34(-2)	<2.0(-4)	3.29(-4)	<2.0(-4)		2.63(-2)
45	TOP	1.04	4.49	4.78	6.63	4.43(-2)	3.35(-1)	5.43(-1)		17.86
	12	2.55	11.3	12.0	7.18	4.02(-2)	3.56(-1)	1.01		34.43
	24	4.33(-3)	1.66(-2)	1.79(-2)	6.83(-3)	<2.0(-4)	6.99(-4)	3.04(-3)		8.30(-2)
	36	9.78(-2)	3.55(-1)	4.09(-1)	2.07(-1)	<2.0(-4)	1.42(-2)	5.53(-2)		1.13
46	TOP	<2.0(-4)	<2.0(-4)	6.67(-4)	1.26(-2)	<2.0(-4)	<2.0(-5)	<2.0(-4)		1.32(-2)
	12	1.84(-1)	6.88(-1)	7.75(-1)	4.88(-1)	3.92(-3)	2.28(-2)	7.77(-2)		2.24
	24	1.85(-3)	6.99(-3)	6.73(-3)	6.08(-3)	<2.0(-4)	2.18(-4)	1.02(-3)		2.28(-2)
	36	<2.0(-4)	5.38(-4)	3.38(-4)	3.37(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		
47	TOP	2.70(-1)	1.15	1.27	1.72	1.83(-2)	4.28(-2)	1.33(-1)		4.60
	12	1.02(-1)	3.73(-1)	3.98(-1)	4.08(-1)	2.96(-3)	1.42(-2)	4.59(-2)		1.34
	24	1.92(-3)	8.01(-3)	8.30(-3)	1.28(-2)	<2.0(-4)	3.86(-4)	1.20(-3)		3.26(-2)
	36	1.23(-3)	3.03(-3)	3.60(-3)	9.01(-3)	<2.0(-4)	3.19(-4)	<2.0(-4)		1.72(-2)
48	TOP	1.05(-3)	3.37(-3)	3.36(-3)	8.68(-3)	<2.0(-4)	2.66(-4)	<2.0(-4)		1.67(-2)
	12	1.38(-1)	4.72(-1)	5.19(-1)	5.75(-1)	5.07(-3)	2.47(-2)	5.72(-2)		1.79
	24	1.33(-4)	5.80(-4)	5.32(-4)	7.72(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		8.97(-3)
	36	3.29(-4)	1.40(-3)	1.68(-3)	2.99(-3)	<2.0(-4)	1.13(-4)	2.0(-4)		6.51(-3)
49	TOP	<2.0(-4)	2.85(-3)	2.77(-3)	1.78(-2)	2.09(-4)	6.10(-4)	<2.0(-4)		2.92(-2)
	12	<2.0(-4)	2.51(-3)	2.91(-3)	4.79(-2)	<2.0(-4)	2.61(-4)	<2.0(-4)		5.36(-2)
	24	<2.0(-4)	<2.0(-4)	<2.0(-4)	6.35(-2)	<2.0(-4)	1.47(-4)	<2.0(-4)		6.36(-2)
	36	4.66(-3)	1.83(-2)	1.90(-2)	1.07(-1)	7.14(-4)	1.41(-3)	6.57(-3)		1.57(-2)

TABLE 6. (cont.) GAMMA ACTIVITY LEVELS IN CPP SOIL (nCi/gm)

Sample #	Level (in)	Eu-155	Eu-154	Eu-152	Cs-137	Cs-134	Co-60	Ce-144		Total γ
50	TOP	4.04(-3)	1.41(-2)	1.44(-2)	2.94(-1)	2.31(-3)	2.50(-2)	5.91(-3)		3.59(-1)
	12	1.19	4.56	5.15	10.5	6.57(-2)	4.71(-1)	5.81(-1)		22.52
	24	1.86(-3)	6.88(-3)	7.91(-3)	6.34(-2)	3.51(-4)	3.92(-3)	1.24(-3)		8.55(-2)
	36	2.24(-3)	5.82(-3)	6.89(-3)	1.08(-2)	<2.0(-4)	1.45(-3)	9.60(-4)		2.82(-2)
Seven	24	4.41(-3)	1.67(-2)	1.93(-2)	2.89(-2)	<2.0(-4)	2.83(-3)	5.49(-3)		7.76(-2)
Foot	36	8.45(-4)	1.74(-3)	1.98(-3)	2.26(-3)	<2.0(-4)	1.09(-4)	<2.0(-4)		6.93(-3)
West	48	2.0(-4)	4.73(-4)	2.0(-4)	1.05(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		1.52(-3)
Hole	60	1.05(-4)	<2.0(-4)	3.54(-4)	1.58(-3)	<2.0(-4)	<2.0(-5)	<2.0(-4)		1.93(-3)

strata of more active soil appears to exist at the 12-inch depth level.

A fissile material assay was completed in conjunction with the gamma analysis. The results are summarized in Table 7 and are visually shown as a function of depth by Figures 33 to 40. A comparison of the gamma analysis figures and fissile material figures shows a very close correlation in the contours and general shape of the display plots. It is noted that the fissile material assay, unlike the isotropic fissile material assay, cannot distinguish the neutron sources; hence, a plutonium and uranium source separation is possible with this type of analysis. For the development of the plots and figures, a background of fissile material was given at 2.6×10^{-2} μgm. fissile /gm of soil.

A Sr-90 analysis was done on the seven-foot core samples to establish a ratio of beta radiation to gamma radiation. The results of this analysis are summarized in Table 8. The alpha/beta ratio presents a wide scatter of data; hence, a ratio cannot be established from the data in Table 8, since the ratio calculated may vary over two orders of magnitude.

TABLE 8. Sr-90 BETA RADIATION ANALYSIS

Sample	Total γ activity $\frac{nCi}{gm.}$	Sr-90 β activity $\frac{nCi}{gm.}$	γ/β
7 ft. at 24 in. level	7.6 (-2)	1.2 (-2)	6.47
7 ft. at 36 in. level	6.93 (-3)	7.3 (-3)	0.95
7 ft. at 48 in. level	1.52 (-3)	3.3 (-1)	4.606(-3)
7 ft. at 60 in. level	1.93 (-3)	1.3 (-2)	0.148

TABLE 7. FISSILE MATERIAL ASSAY FOR CPP SOIL

Sample No.	Level (in.)	U-235 (µg/g)	Sample No.	Level (in.)	U-235 (µg/g)
1	Top	2.7 (-2)	10	Top	2.6 (-2)
	12	2.5 (-2)		12	2.6 (-2)
	24	6.3 (-2)		24	2.3 (-2)
	36	3.0 (-2)		36	2.5 (-2)
2	Top	2.5 (-2)	11	Top	3.2 (-2)
	12	2.5 (-2)		12	2.6 (-2)
	24	4.5 (-2)		24	2.6 (-2)
	36	5.9 (-2)		36	2.3 (-2)
3	Top	2.9 (-2)	12	Top	4.0 (-2)
	12	3.3 (-2)		12	2.7 (-2)
	24	4.4 (-2)		24	3.0 (-2)
	36	2.5 (-2)		36	2.7 (-2)
4	Top	2.7 (-2)	13	Top	2.4 (-2)
	12	2.9 (-2)		12	3.7 (-2)
	24	2.4 (-2)		24	3.2 (-2)
	36	2.4 (-2)		36	2.4 (-2)
5	Top	2.6 (-2)	14	Top	2.7 (-2)
	12	2.5 (-2)		12	2.9 (-2)
	24	2.4 (-2)		24	2.5 (-2)
	36	2.5 (-2)		36	2.7 (-2)
6	Top	2.6 (-2)	15	Top	2.7 (-2)
	12	3.5 (-2)		12	2.6 (-2)
	24	2.6 (-2)		24	2.9 (-2)
	36	2.6 (-2)		36	2.4 (-2)
7	Top	7.7 (-2)	16	Top	5.0 (-2)
	12	2.4 (-2)		12	2.5 (-2)
	24	2.6 (-2)		24	3.3 (-2)
	36	3.7 (-2)		36	2.4 (-2)
8	Top	2.6 (-2)	17	Top	2.9 (-2)
	12	4.3 (-2)		12	2.2 (-2)
	24	2.8 (-2)		24	2.9 (-2)
	36	2.6 (-2)		36	2.3 (-2)
9	Top	2.7 (-2)	18	Top	2.3 (-2)
	12	2.8 (-2)		12	5.4 (-2)
	24	2.6 (-2)		24	2.5 (-2)
	36	2.5 (-2)		36	2.9 (-2)

TABLE 7 (cont.) FISSILE MATERIAL ASSAY FOR CPP SOIL

Sample No.	Level (in.)	U-235 (µg/g)
19	Top	2.9 (-2)
	12	2.5 (-2)
	24	2.5 (-2)
	36	2.4 (-2)
20	Top	2.7 (-2)
	12	2.5 (-2)
	24	2.6 (-2)
	36	2.4 (-2)
21	Top	2.6 (-2)
	12	5.7 (-2)
	24	3.5 (-2)
	36	2.5 (-2)
43	Top	3.3 (-2)
	12	4.6 (-2)
	24	3.3 (-2)
	36	2.5 (-2)
44	Top	1.1 (-1)
	12	5.1 (-2)
	24	3.2 (-2)
	36	2.6 (-2)
45	Top	1.0 (-1)
	12	1.4 (-1)
	24	3.0 (-2)
	36	5.7 (-2)
46	Top	2.6 (-2)
	12	2.8 (-2)
	24	3.0 (-2)
	36	2.6 (-2)
47	Top	3.9 (-2)
	12	3.7 (-2)
	24	2.7 (-2)
	36	2.4 (-2)
48	Top	2.5 (-2)
	12	2.7 (-2)
	24	2.4 (-2)
	36	2.5 (-2)
49	Top	2.5 (-2)
	12	2.6 (-2)
	24	2.5 (-2)
	36	4.5 (-2)
50	Top	2.6 (-2)
	12	5.1 (-2)
	24	2.6 (-2)
	36	2.5 (-2)
Seven	24	2.6 (-2)
Foot	36	2.5 (-2)
West	48	2.9 (-2)
Hole	60	2.6 (-2)

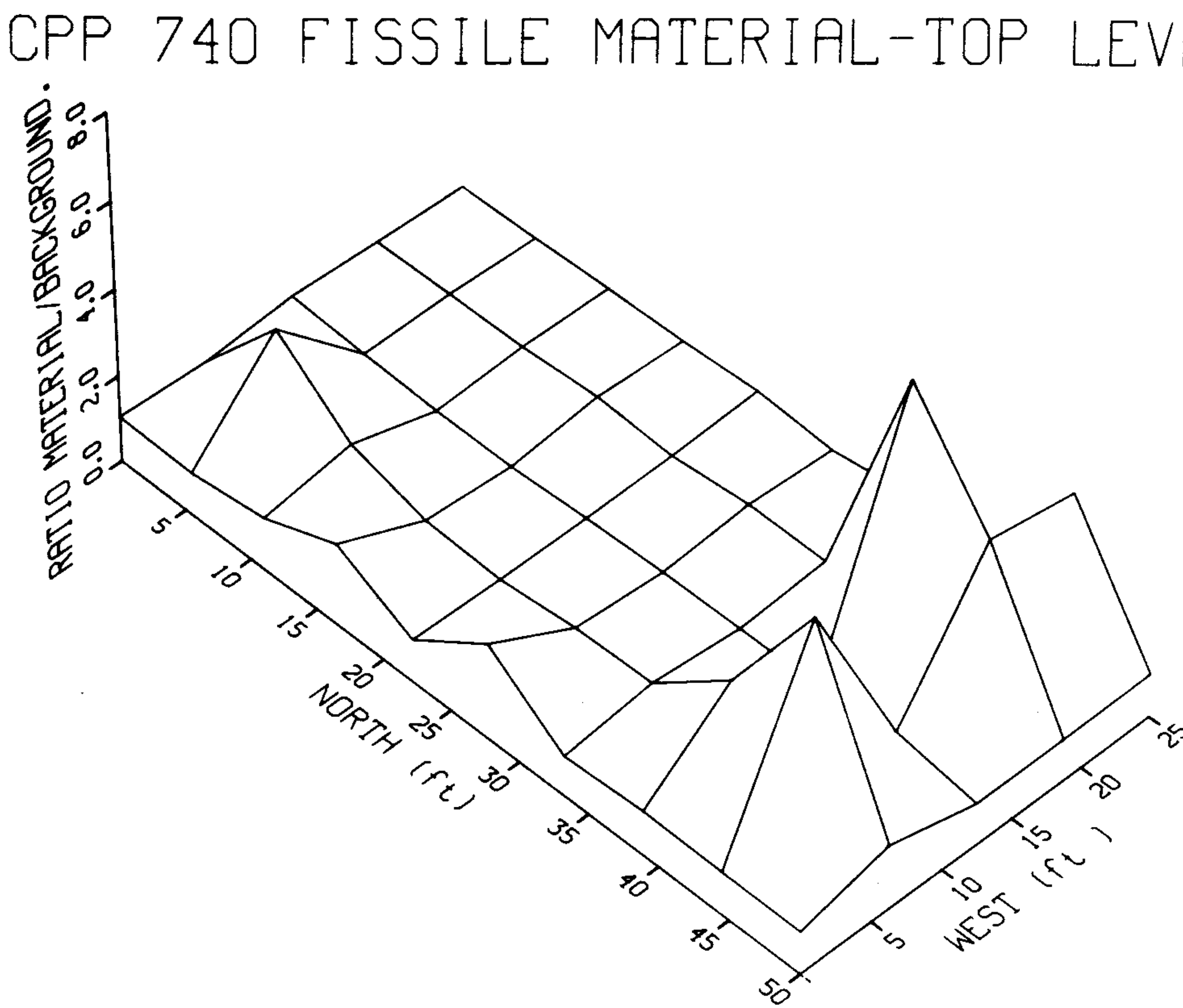

Figure 33. Fissile material level, surface level, looking southeast.

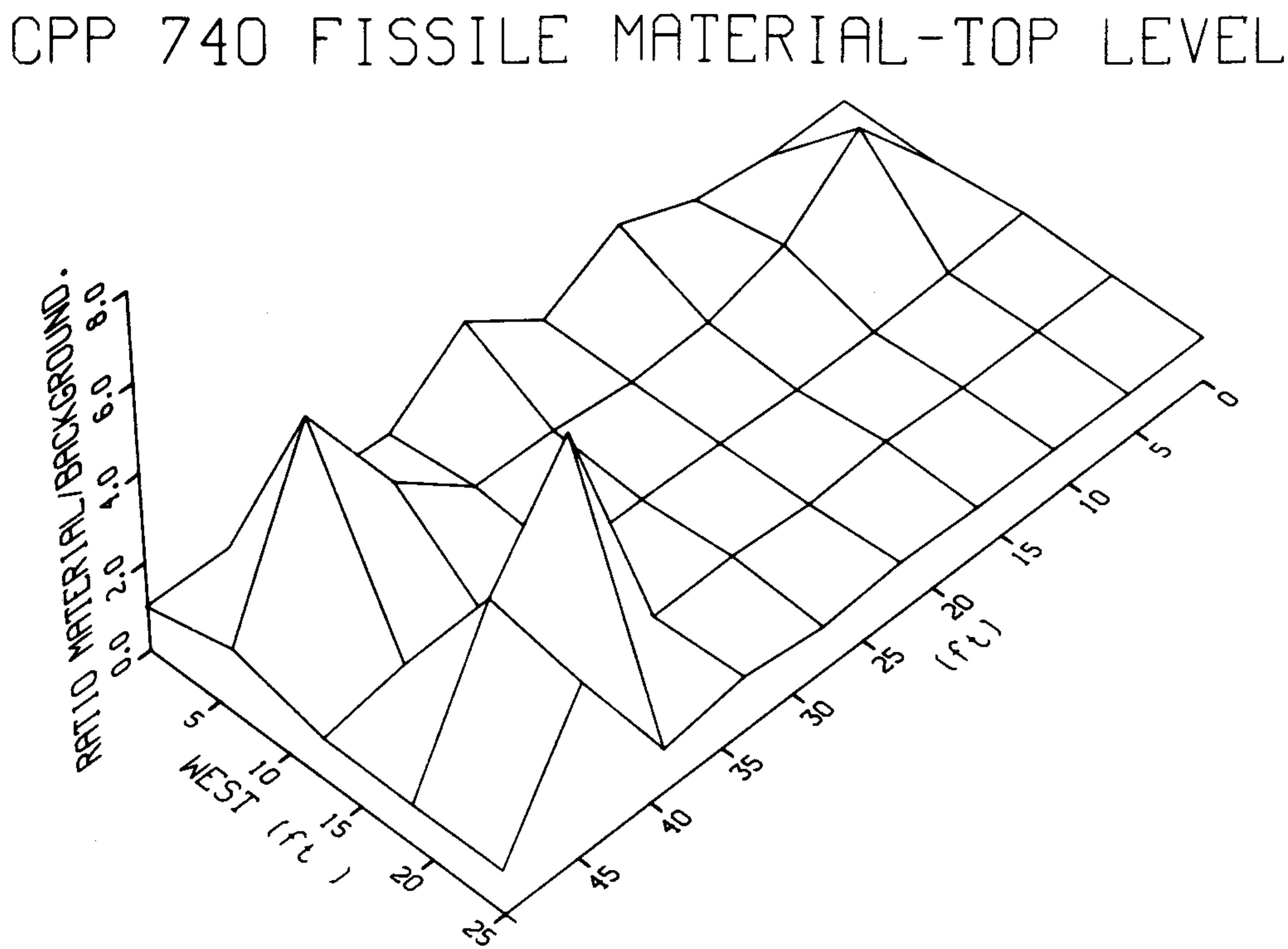

Figure 34. Fissile material level, surface level, looking northeast.

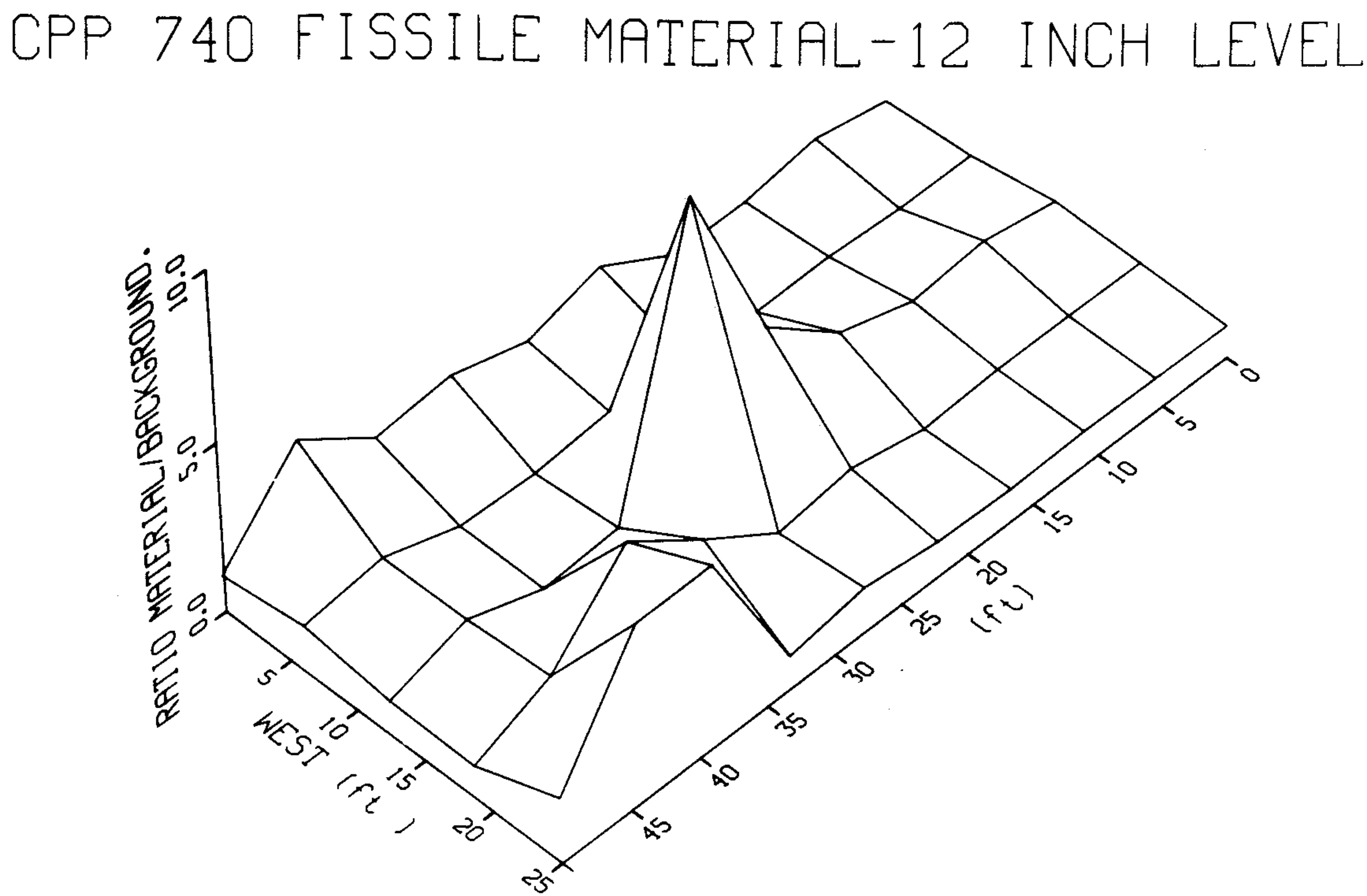

Figure 35. Fissile material level, 12-inch depth, looking southeast.

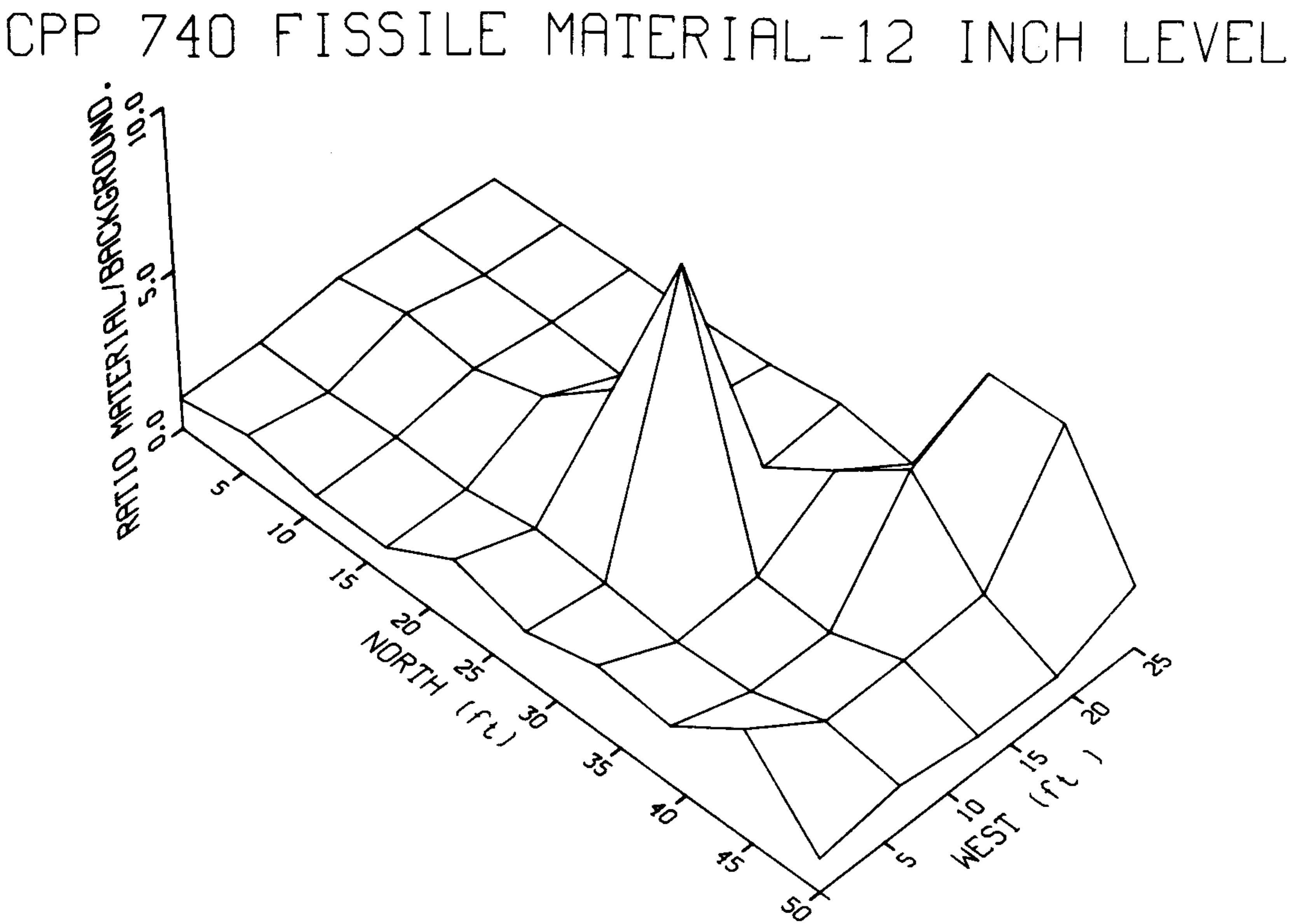

Figure 36. Fissile material level, 12-inch depth, looking northeast.

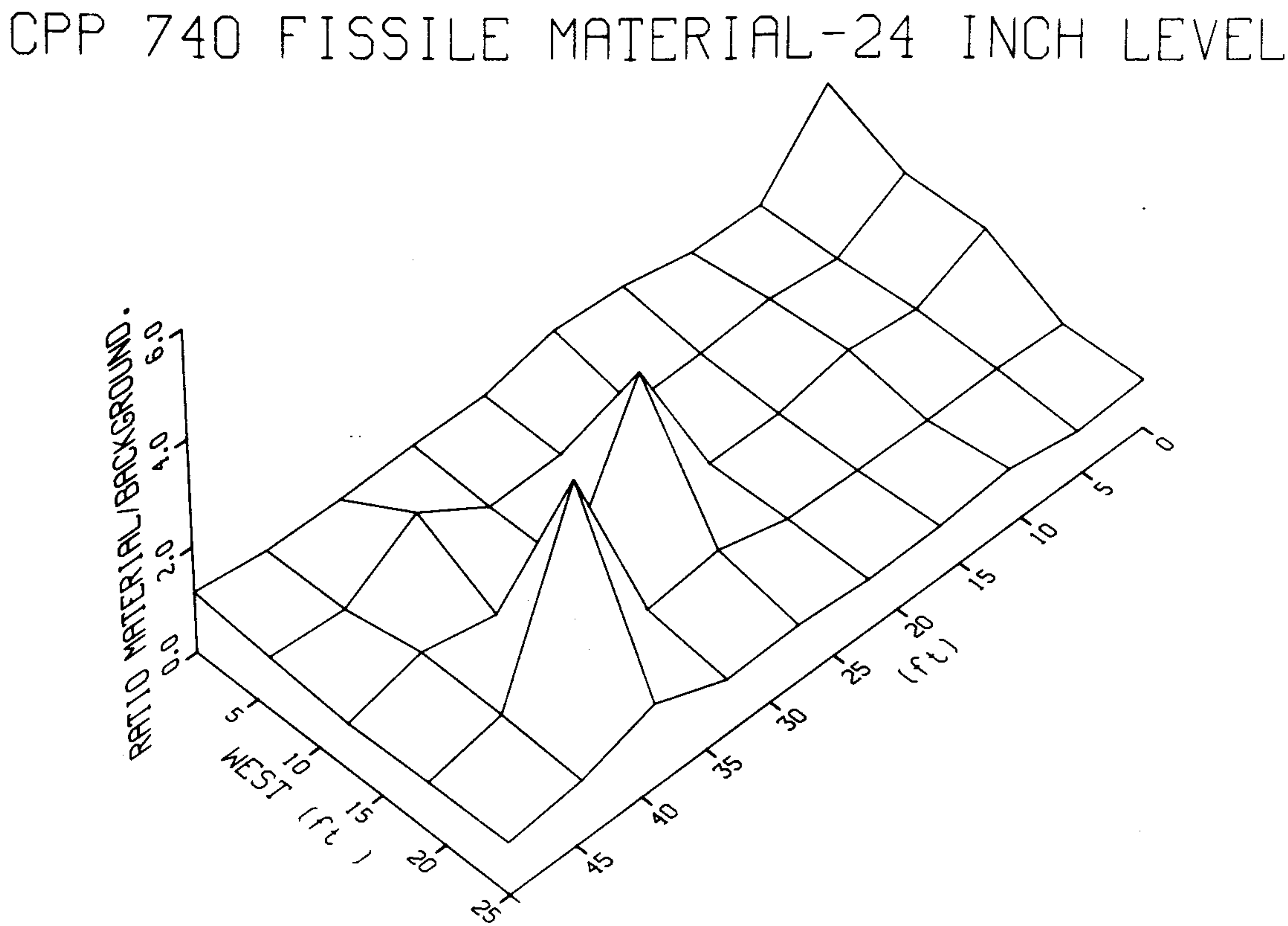

Figure 37. Fissile material level, 24-inch depth, looking southeast.

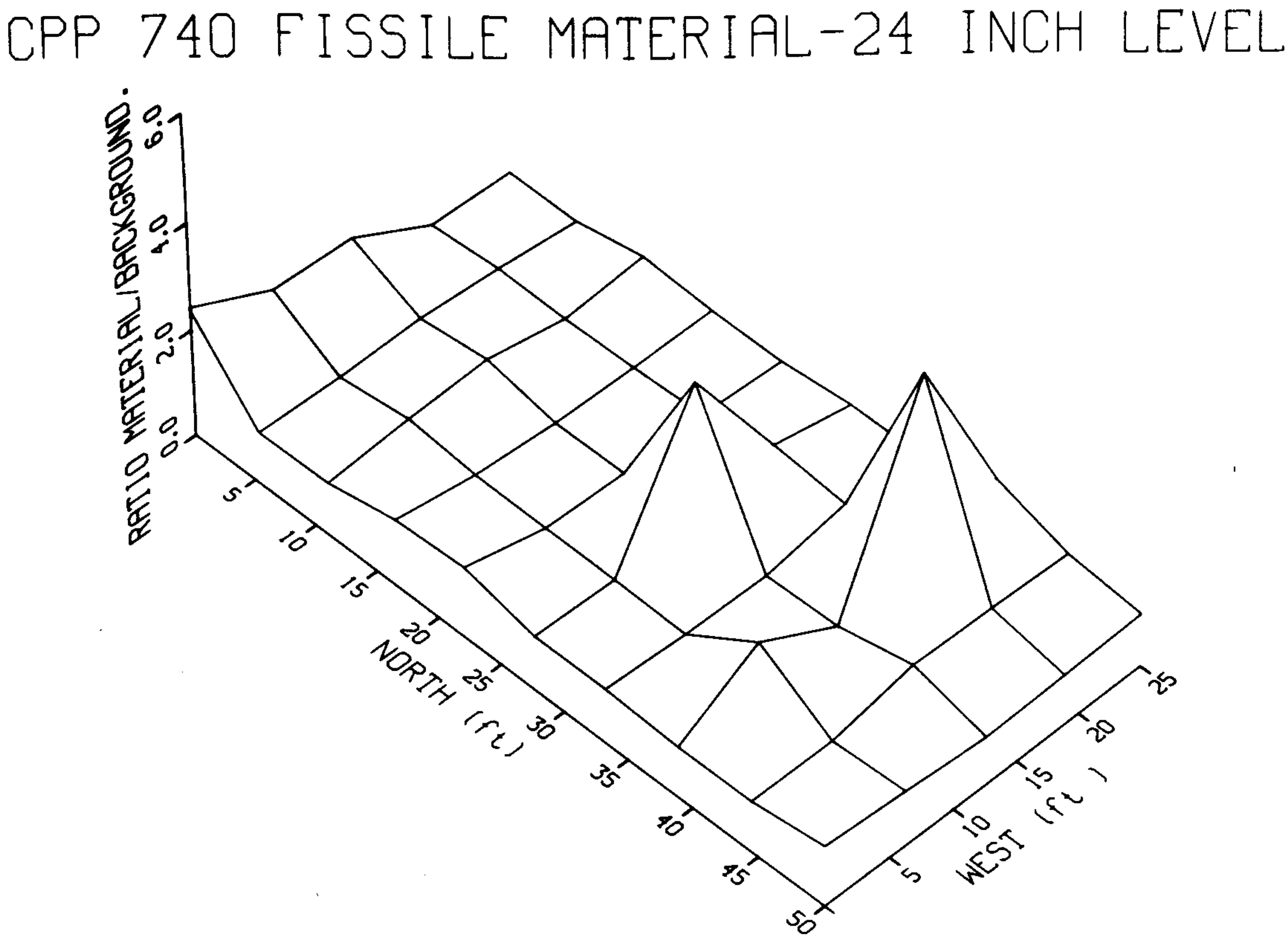

Figure 38. Fissile material level, 24-inch depth, looking northeast.

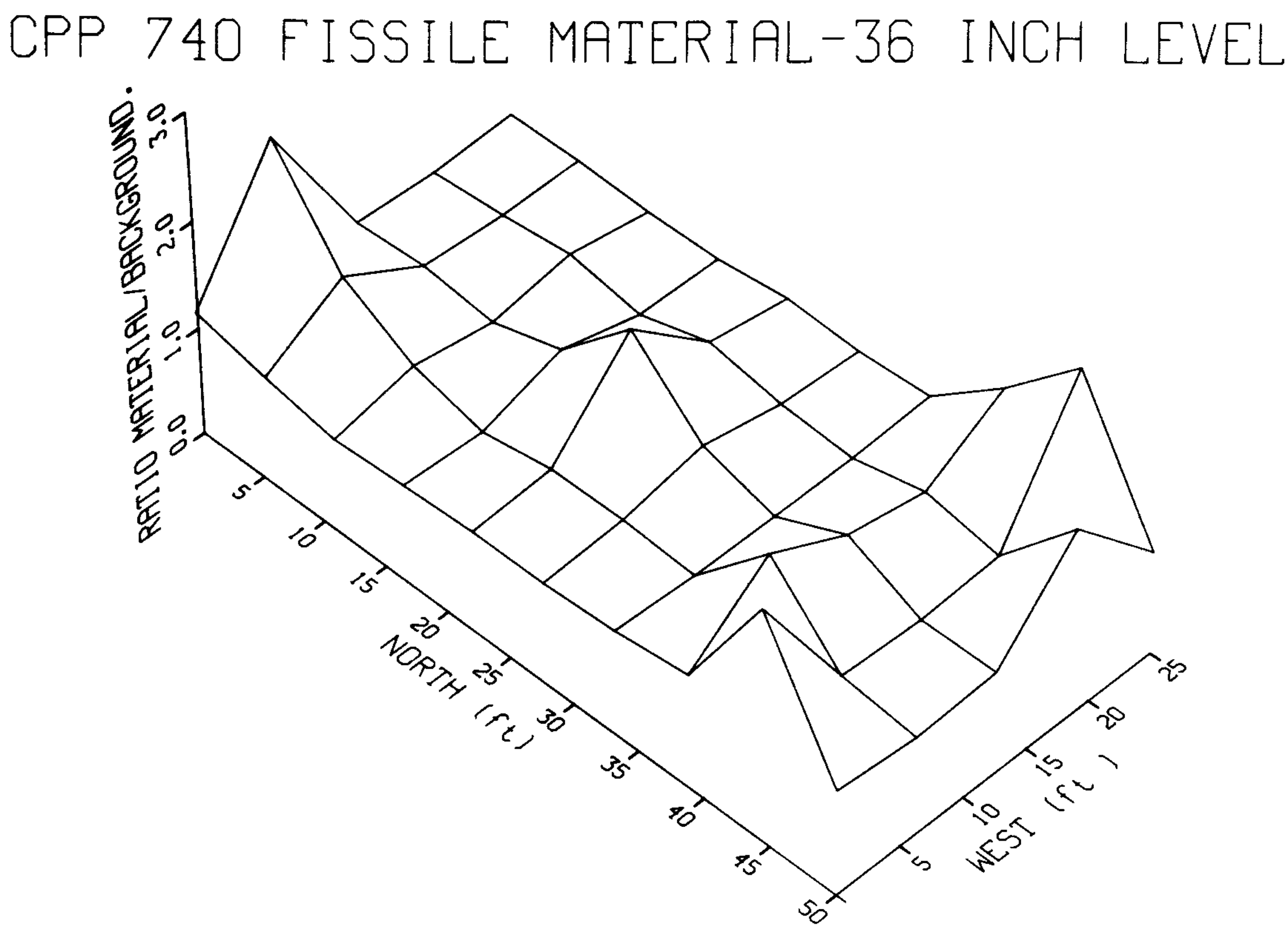

Figure 39. Fissile material level, 36-inch depth, looking southeast.

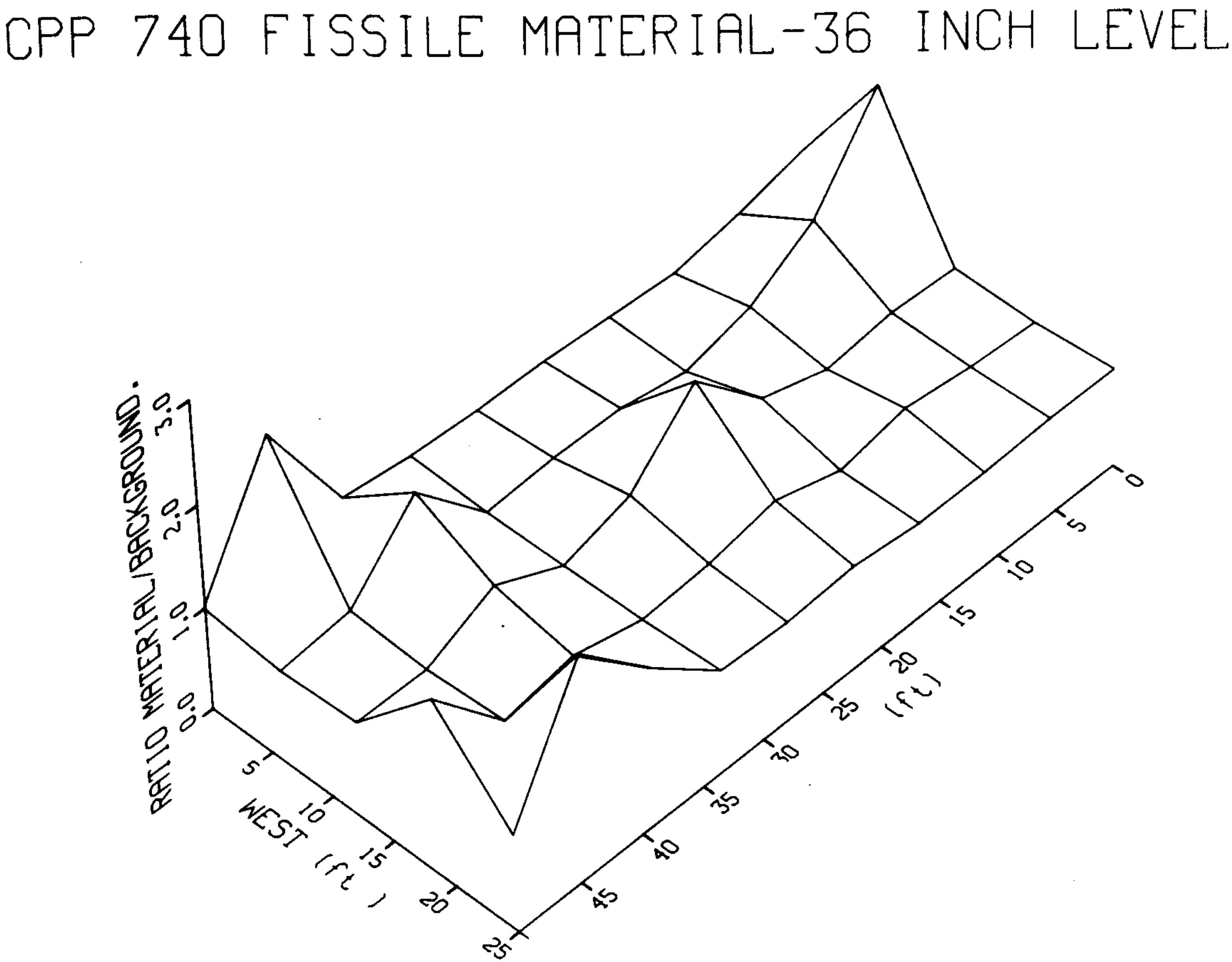

Figure 40. Fissile material level, 36-inch depth, looking northeast.

5. WASTE VOLUME AND WEIGHT

An estimation of the total waste generated from a cleanup, decontamination, and decommissioning operation of the CPP-740 area has been done and is summarized in this section. The figures in Table 9 show the total waste volume and weight assuming that the entire facility were to be excessed. The majority of the waste volume expected to be generated is from the excavation of the soil of the enclosure. The removal of the soil

is assumed if the INEL criteria for contaminated soil removal is at 1 nci/gm. Therefore, the total waste volume generation to remove the CPP-740 facility would be 4,181 ft^3 and would result in a total weight of 422,111 lbm.

TABLE 9. WASTE VOLUME AND WEIGHT OF CPP-740

		Facility		
Material	CPP-304	Settling Basin	Dry Well	Facility (Total)
Concrete[a]				
Volume	213.84 ft^3	681.86 ft^3	142.40 ft^3	1,038.1 ft^3
Weight	29,356 lbm	93,606 lbm	19,549 lbm	142,511 lbm
Sludge[b]				
Volume	150 ft^3	168.75 ft^3	N/A	318.75 ft^3
Weight	13,119 lbm	14,758 lbm		27,877 lbm
Wood				
Volume	N/A	24.29 ft^3	N/A	24.29 ft^3
Weight		972 lbm		972 lbm
Piping				
Volume				39.81 ft^3
Weight				9,359 lbm
Soil[t]				
Volume				2,760 ft^3
Weight				241,390 lbm

a. Concrete weight is based on stone concrete density of 137.28 lbm/ft^3()

b. Sludge weight is based on dry earth density of 87.46 lbm/ft^3()

t. Assuming dirt removal of enclosure down to the 3 foot level.

6. DRAWING LIST

A. F. C. Torkelson drawings.

1. 842-CPP-740-S-1 CPP Settling Basin and Dry Well - Plan and Section

2. 842-CPP-104-1 CPP Settling Basin and Dry Well - Plot Plan and Vacinity Map

B. Foster - Wheeler drawings

1. 542-31-P29 - S. F. Storage Building CPP-603 - Arrangement of Water and Drain Piping.

2. 542-62-G3 - S. F. Storage Building Area - Details of 5'-0" I.D. manholes

C. Idaho Nuclear Corporation Drawings.

1. 200-0603-51-400-054411-SF Storage Bldg. - CPP-603 Vacuum Filter Installation

D. Allied Chemical Corporation Drawings

1. 200-0200-52-030-055345 CPP Area - Underground Utilities Systems Unit 39-3 Division 8 Block 21

2. 200-0740-65-030-055984 - CPP-740 Manhole Cover.